The IRON AGE
MAY 1 1942
APRIL 30, 1942

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Turret Lathes
Cleveland
THEY KNOCKED THE CHIP
OFF UNCLE SAM'S SHOULDER!
OK! LET'S SHOW 'EM CHIPS!

APRIL 30, 1942
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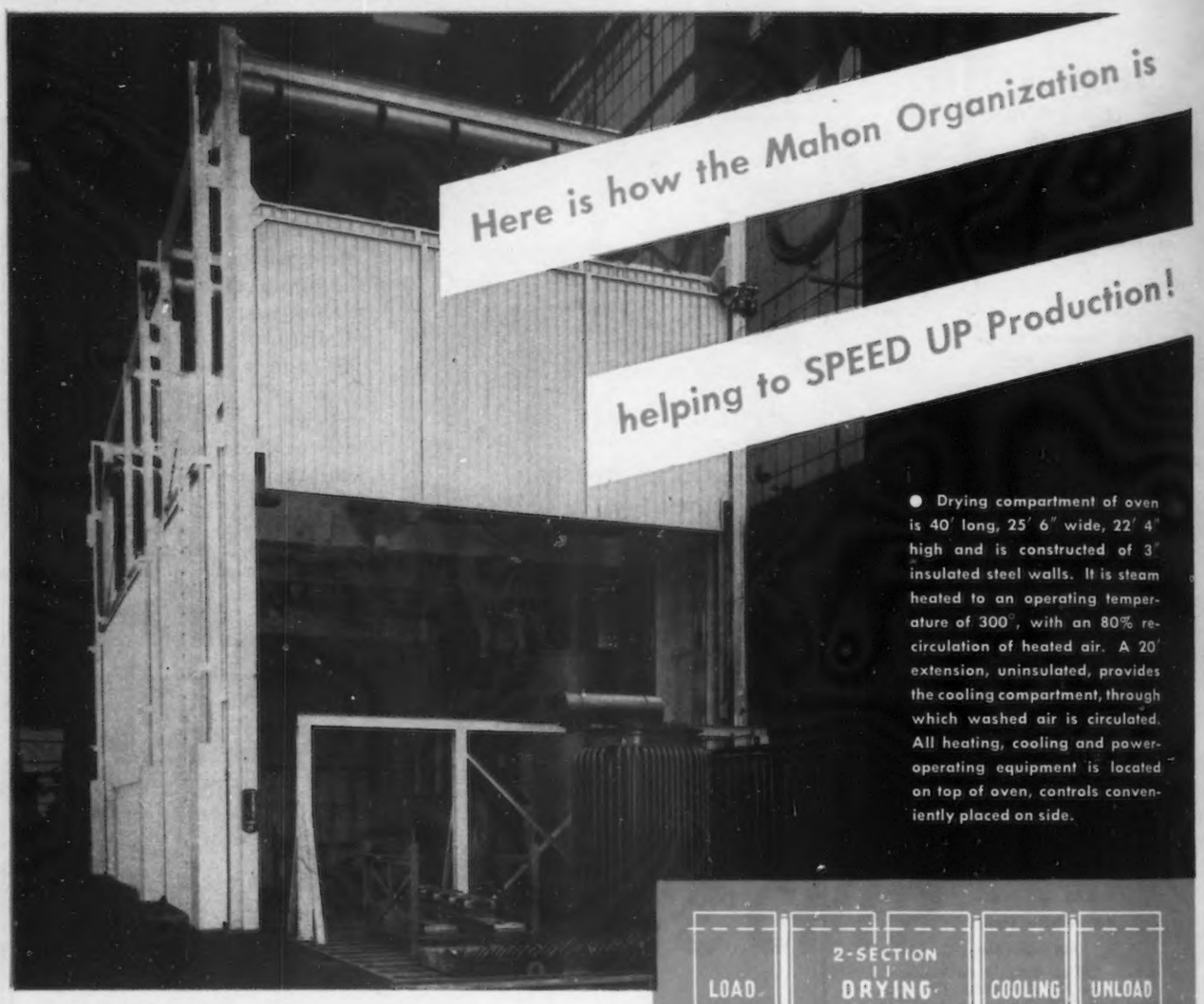
This Week in . . .
THE IRON AGE



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THE IRON AGE

APRIL 30, 1942

ESTABLISHED 1855

The Seventh Column

THERE is one thing that you can quite safely bet on and that is that the American people, as a whole, are going to insist upon our winning this war. And by the same token, the American people are not going to stand for any "monkey business" that interferes with this great purpose, once they detect it going on.

This, I think, is perfectly evident from the tidal wave of public demand that has descended upon Congress in connection with union labor practices or rackets which have hampered or are hampering our all-out efforts in this country.

Thanks to an aroused public opinion, these vicious practices are slated for the "ash can" and any legislator who thinks differently or acts contrary to the public will in this matter may well find himself heading for the same destination on election day.

Next due for public attention and action, I think, is the "seventh column" which has been sticking its head out of the ground during the past few months and wriggling its forked tongue.

It is a legitimate descendant of the same family of invertibrates which, consciously or unconsciously made the Kaiser's job easier for him during the preceding war.

The target for the venom of these slimy invertibrates during 1917 and 1918 were the "swivel chair officers" in Washington and elsewhere in this country. What was to be inferred from their outgivings was that any officer or enlisted man who was compelled to stay in this country because he did not have the privilege of being sent overseas was a poltroon and a coward. "He wore spurs," so they said, "to keep his feet from sliding from his desk."

Today, the target for the descendants of this same group of invertibrates, none of whom, incidentally, are in the armed forces either abroad or at home, are the business men and industrialists of America. Especially those who have answered their country's call and gone to Washington, or elsewhere, to serve for a dollar a year.

They, and American business as a whole, are now being subjected to the most contemptible and slanderous campaign of vilification that this country has as yet been unprivileged to see or hear.

If this sort of stuff does not work directly for the benefit of Hitler and Hirohito, I miss my guess. Even though it may be a "red herring" that is being drawn across the trail of labor racket reforms, it is something that is doing untold harm to the American and Allied cause.

I think that the average American is sufficiently intelligent to reject this foul propaganda and sufficiently patriotic to eject its perpetrators.

J. H. Van Deventer

Privileges and Obligations Go Together

You do not have to tell Jimmy's dad that he is a privileged man—privileged to have Jimmy—privileged to watch Jimmy grow and develop in a free country. Nor do you have to tell him that he has the obligations to safeguard Jimmy—to see that he grows up to be a strong man—an intelligent man—a true American with pride in his heritage of freedom and with a strong sense of duty to his country.

Like Jimmy's dad, we at Inland have always believed that all privileges have correlative obligations—that to keep the privileges of freedom we must faithfully fulfill our obligations to free government.

That is why, in times of peace, Inland steadily expanded its mills, developed new methods, delved deeply into research—all to the end that America and her industries would have the right kind of steel, in the right quantities, to help America grow.

When war clouds gathered, we considered it Inland's duty to respond with steel needed for defense. Today, Inland is expanding output, working day and night without pause to help America win by carrying the fight to the aggressors.

In the eventual peace Inland, all industry, and all patriotic Americans will still enjoy the privileges of freedom because of fulfilled obligations.

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While warbling the roundelay that American food would write the peace, this country has floundered near the ragged edge of not enough food to win the war. For, it is the prosaic tin can that must carry the food to civilians at home, chow to soldiers and provisions to allies at the world's four corners. And, only by digging fast and deep into its conjure-bag has the tin plate industry offset the fateful fact that Japan is now encamped on most of the world's tin.

By T. W. LIPPERT
Managing Editor, The Iron Age

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SUCKLED and reared in a lush economy of plenty, the American steel industry in climacteric 1941 has already been impressed with the bitter fact that necessity, the proverbial mother of invention, is on occasion a rather grim dame, somewhat bewildered by a whirlwind courtship, a shotgun marriage, and a Caesarean operation. The necessity for successive record quantities of steel out of third-rate scrap, the need for more and more quality steel notwithstanding dwindling supplies of alloying elements, and demands on steel to shore up soft spots in other metals (cartridge cases, aircraft, etc.), all have been faced for the first time, and successfully faced at that, with remarkable aplomb and commendable lack of fanfaronada.

Now there is disruption in that long-established sensitive relationship between tin miners in distant Malaya, producers of steel in Pittsburgh, and growers of vegetables in California. Consequently, the industry's new baby—electrolytic tin plate—can no longer be left to slowly mature in elegant conservatism, but of sheer necessity must quickly and effectively assume a dominant role so that America may eat. Oh, and how popular baby is today! Only a few months ago electrolytic tinplate's father spoke of him almost with apologetic reluctance, but today a variety of fathers, foster fathers, godfathers, and miscellaneous consorts coo and goo and march him proudly down the avenue.

Of the innumerable grim military and industrial problems brought into sharp focus by Japan's Pearl Harbor *coup de main*, certainly far from the least was the certainty of abrupt liquidation of the very neat and tidy international cartellization of world pig tin production, so characteristic of the industry since 1934. Just about the time the scandal of the Penang evacuation was shocking the Allied world, it even became quite obvious to professional optimists that the United States, a country using over half the world's tin, was destined to have to squeak by with stocks on hand and afloat, and a moderate flow from Bolivia via Jesse Jones' Texas refinery.[1] The harsh cathartic of necessity cut through the usual mental costiveness of Washington, and plans were whipped up with exemplary speed for strict allocation of existing tin supplies. Bearing makers scurried to reexplore low-tin and tin-less bearing alloys, and solder producers on March 17 (order M43A) were forced to drop the tin content of certain solders and shifted attention to the various low-tin-silver-bismuth-lead solders and to the tin-free lead-silver alloys. The doom of collapsible tubes was sounded, and impregnated fabric, paper, and silver were scrutinized in desperate haste.

For the $500,000,000 tin plate section of the steel industry, however, the consequent upheaval is of really dramatic proportions, laced with many competitive overtones and technical ramifications. Both the tin plate industry and the Government have initiated an extensive pattern of moves to stretch the meager tin supply. For over two months now governmental regulations have been in force prohibiting the use of tin for purposes not essential to military or civilian subsistence (WPB order M-43-a, killing off toys, household novelties, etc., etc.); standardization of can sizes to Nos. 2, 2½ and 10, and restricting size of packs for various foods of secondary importance (WPB order M-81, Tables I, II and III); and rationing on an arbitrary scale based on past methods and uses has been adopted. But unfortunately, these moves alone were only minutiae in the over-all solution to the problem.

Quite obviously it became imperative that the allocation of tin take the following order of preference:

(1) Munitions.

(2) Food containers for the armed forces.

(3) Food containers for Allies (Lend-Lease).

(4) Civilian subsistence.

The Government estimates, based on the various regulations issued to date, indicate the quantity of pig tin available for tin plate production in 1943 will be about 24,000 tons. However, there seems to be some confusion amongst different parties in the estimated 24,000 tons of metallic tin available. Some authorities have used the figure as gross tons and some as net tons. There has been so much misunderstanding on this subject that no one is quite able to authenticate either the 24,000 or the variety of ton, but the chances, making allowance for confusion and uncertainty, seem to favor the gross ton. The tin used

in the production of terne plate is provided by a separate allocation (about 5,000,000 boxes for 1943). But the other very sharp horn of the dilemma is that further estimates show that tin mill product requirements for 1943 for all purposes will be 76,000,000 base boxes in the industry's terminology, or roughly 3,258,000 gross tons.

Over the past decade average conversion has dropped from a theoretical 100 lb. to about 92 lb. of tin plate per base box. Now, since order M-81, size and gage of plate for standardized cans has run the average conversion up to perhaps 97 lb. of tin plate per base box. This latter figure is used herein.

For many years the standard practice has been to use 1.5 lb. of tin to coat one box of coke tin plate. Subject to minor exceptions the Government has progressively forced this tin down (WPB order M-21-e) to a current weight of 1.25 lb. per box of tin plate, with certain exceptions, civilian and military (average is about 1.27 lb., which is used herein). A 1.25-lb. coating is usually conceded as the very minimum quantity which can be satisfactorily applied by the generally employed hot-dip process. Therefore, a little calculation shows that at this figure, 24,000 gross tons of pig tin will hot-dip coat 42,000,000 boxes, against the requirement of 76,000,000 boxes. This severe unbalance has made it necessary for the Government to wipe out some of the casual uses of a more cushy era, prohibiting the use of tin plate in making containers for commodities such as dog food, tobacco, beer, dried beans, pork and beans, baking powder, cereals, flour, petroleum products, spices, condiments, etc. The resultant savings tally up to about 6,000,000 boxes.

The problem before the industry, therefore, boils down to the following:

Total container requirement	= 76,000,000 boxes
Less amount which can have no tin	= 6,000,000 boxes
Balance on which tin may be used	= 70,000,000 boxes

But regardless of the severest rationing, allocating or other miscellaneous arbitrary procedures attempted, the Army, Navy and civilian population can't win the war on bloated stomachs—they must be fed. And there is no sensible substitute for the metal container in taking care of any appreciable part of this problem. Certainly glass containers are impractical, because of weight, fragility, use of rubber in the closure, exposure of contents to light, and—most important—because packers are not equipped to handle glass in volume and would require two years to square away for such a task. And, unfortunately, people can starve to death in 30 days. Dehydrated foods, growing somewhat in acceptance, are also severely limited because of success for only certain types of food, and because of the need of pure water at the point of consumption—for example, powdered tomato juice plus Philadelphia water would be an interesting experience indeed. And, no longer can armies copy Genghis-Khan's Mongols, who route-marched over 60 degrees of longitude, living off the land and opening up the veins of their spare mounts for frequent blood cocktails.

For all these reasons it thus became the responsibility of tin plate producers and the can makers to work out a practical answer to the canning problem, not only to prove their own viability but also to prevent jeopardy of the war effort. And, most creditably, a solution has been devised, the recommended approach being as follows:

Pig tin available	= 24,000 gross tons
Total need of tin plate	= 70,000,000 boxes
Quantity which must be hot dipped:	
Armed forces and Allies	= 20,000,000 boxes
Civilian	= 10,000,000 boxes
Total	= 30,000,000 boxes

The 30,000,000 basis boxes which must be hot dipped will account for 17,300 gross tons of pig tin, leaving 6700 gross tons. The problem is thus narrowed down to providing the country with 40,000,000 boxes of material for food containers and using not more than 6700 gross tons of pig tin to do the job.

The solution is for the industry to produce:

30,000,000 boxes with 0.5 lb. tin coating.
10,000,000 boxes with a lacquered surface.

The electrolytic method of plating is the only process which will yield usable plate with a 0.5-lb. coat. The United States Steel Corp. has a very successful electrolytic line in operation at the Carnegie-Illinois Gary plant, Crown Cork & Seal Co., Inc., has already plated over 1,000,000 boxes at Baltimore, and Crucible Steel Co. of America has a line at Midland, Pa. Three new lines are now nearing completion by the U. S. Steel Corp. (THE IRON AGE, Jan. 1, 1942, p. 54), Crown is ready to turn over a new and faster line, and there is a scattered amount of new capacity at the moment actually under way. As regards capacity for the chemical treatment of black plate, which is the necessary preliminary for large scale lacquer coating, the U. S. Steel Corp. has the only unit actually in operation. It is an experimental pilot line at Gary tin mill, Carnegie-Illinois Steel Corp.

There are, however, a great many plans brewing in the industry, and the tin plate producers and the can companies and the packing industry fully understand the situation and realize there is no alternative course open. Reducing everything to figures, the material and process setup for 1943 is as follows:

Process	Requirement Boxes	Gross Tons Pig Tin Used
Hot dipped	30,000,000	17,300
Electrolytic coat	30,000,000	6,700
Chemically treated	10,000,000	....
Plain black plate	6,000,000	....
Totals	76,000,000	24,000

[1] *See* THE IRON AGE, *Feb. 19, 1942, for analysis of Bolivian tin possibilities for the U. S. The Texas refinery will soon initiate production at the rate of 18,000 tons per year, later may move up to a 24,000-ton pace, and may even eventually be shifted up to 52,000 tons a year, the latter accelerated cycle turning out tin containing impurities and usable only in electrolytic installations. The following reviews the world-wide set-up: Purest ores are found in Dutch Islands of Banca (now Jap), the impurities being of such a nature that tin of 99.9 per cent purity is obtainable from ore smelted in an ordinary reverberatory furnace. Extensive Malay ores (now Jap), were generally treated at two smelters, one at Singapore and the other at Penang. Cornish, England, output (not large) comes from mines 3000 ft. deep, the mines frequently extending far under the sea, with miners working in warm water up to their waists. This makes cost of winning the ore very high. Bolivian ores also are rather costly as they occur 10,000 ft. above sea level in an area devoid of fuel. This ore concentrate (60 per cent metallic tin) is shipped to Liverpool for refining, and a considerably poorer concentrate is coming to the new Texas refinery. Nigerian ores also are shipped to Liverpool, England, refinery, but the concentrates assay about 70 per cent tin and the impurities are not so difficult to eradicate as those in the ores from Bolivia. All the Cornish ores are mixed in with those from Nigeria and Bolivia and reduced in the same smelter. Dutch East Indian isles of Banca, Billiton and Sinkep (all now Jap) formerly fed to a Banca and to the large Arnheim, Holland, smelter (now German), and the Belgians had a smelter near Antwerp to deal with the rich low-cost Belgian Congo ores. Important quantities of tin were also produced in China (now Jap), in Siam (now Jap), and in Australia (Tasmania).*

Inasmuch as no problem encountered by the steel industry within recent years has been subject to so much distortion, surplusage, and misinformation, the data already set forth should clarify the outline of the electrolytic tinplate situation. And, the following observations should be of help in bringing various phases of the problem into proper focus:

(1) Some form of tin plate is the only material that fulfills fundamental requirements for a sanitary food can—(a) providing a base for lithographing and protection of can exterior against rusting in storage, (b) internal protection against corrosion of contents, alone or with enamel, (c) contributing to the maintenance of clarity and natural flavor of the food, and (d) particularly important, permit soldering of body seam on can machines at speeds of 300 or more per min. Welding of the side seam still is not nearly fast enough to be commercially feasible. And while dry package cans have a crimp body seam, sanitary cans may undergo an internal pressure of 28 to 30 lb. per sq. in. during processing, and it is absolutely impractical to conceive of a crimped side seam sufficiently tight and strong to withstand such pressure without leaking.

(2) Work is progressing on the soldering of untinned, black or bonderized material. Lead-tin solders have been used on oil cans for some time, but there are still many bugs in high speed sanitary can fabrication. To save even the small amount of tin in such solder, attention is also being given to lead-silver solder alloys, although such application certainly cannot yet be called commercially feasible. None the less, there is no inherent reason why it cannot be worked out by proper attention to such features as mechanical cleaning, active fluxing, deposition on the parts to be joined of a solderable coating such as silver, etc. One particular difficulty to be solved in the 2.5 per cent silver-lead solder is the high melting point of the entectic and absence of a spread between liquidus and solidus temperature, which introduces the problem of wiping excess solder from the can which in turn will require extensive equipment changes for satisfactory performance.

(3) Electrolytic plate carrying 0.5 lb. of tin per box goes far to meet the fundamental requirements including soldering on conventional equipment, the joint often showing a resistance to rupture of 100 lb. per sq. in. This strength is satisfactory for all canning needs.

(4) Large quantities of the electrolytic plate will be used as ends for can bodies made of hot-dip plate (ends are curled and seamed on, not soldered). And, sizable tonnages of chemically treated plate, subsequently enameled, will be used as ends for can bodies made of electrolytic plate.

(5) Plain black plate (oiled, lacquered, or with size coating) will, if available, go into dry packs, such as coffee, biscuits, tobacco, tooth powder, spice, lye, etc. Also, such borderline products as oil, wax, shoe polish, certain bottle caps, screw caps, etc., etc.

(6) Electrolytic bodies plus chemically treated ends, will go to make cans for non-corrosive vegetables such as peas, corn, tomatoes, string beans and perhaps for fruits such as peaches, apricots, pineapples, pears, etc.

(7) Cans made of hot-dip plate, and some of electrolytic plate, will be used for baby foods, milk, some of the highly corrosive fruits such as loganberries, black cherries, prunes, etc., and for much of the food for the various AEF's. And cans of hot dip bodies plus electrolytic ends will carry much of the burden for export products such as beer, lend-lease material in general, and the lower acid foods for the military.

(8) Additional exploratory and experimental work will be required to establish the adaptability of the new products in the canning of certain food packs. However, many questions of corrosion, which in normal times would be approached leisurely and with elaborate experimentation, must be grappled with today without waiting for the usual tedious tests. In the whole set-up there are some shadow zones or marginal areas which must be studied and subjected to test before the most suitable practice can be selected with full confidence. The can manufacturers and packers, as well as the producers of plate, know of the problems involved here, and of the risk of loss consequent upon a false step. Thus all parties at interest are engaged in intensive research work to establish the new program of can making and packing on a foundation of facts and experience.

(9) Undoubtedly the tremendous growth in electrolytic capacity scheduled for the next 12 months will result in a large permanent slice of business taken away from hot-dip. But, by no means does this indicate the extinction of hot-dip plate, as some would have it. As already mentioned, the 1943 setup is partially a stopgap accepted under duress, and there are some shadow zones which would realign themselves just as soon as the present emergency is over. For instance, using the 76,000,000 boxes for 1943, already broken down into processes that the tin shortage dictates, a theoretical breakdown indicative of post-war relationships may possibly be about as follows:

Hot dip	= 30,000,000 boxes
Electrolytic coat	= 36,000,000 boxes
Chemically treated black plate	= 10,000,000 boxes
Total	= 76,000,000 boxes

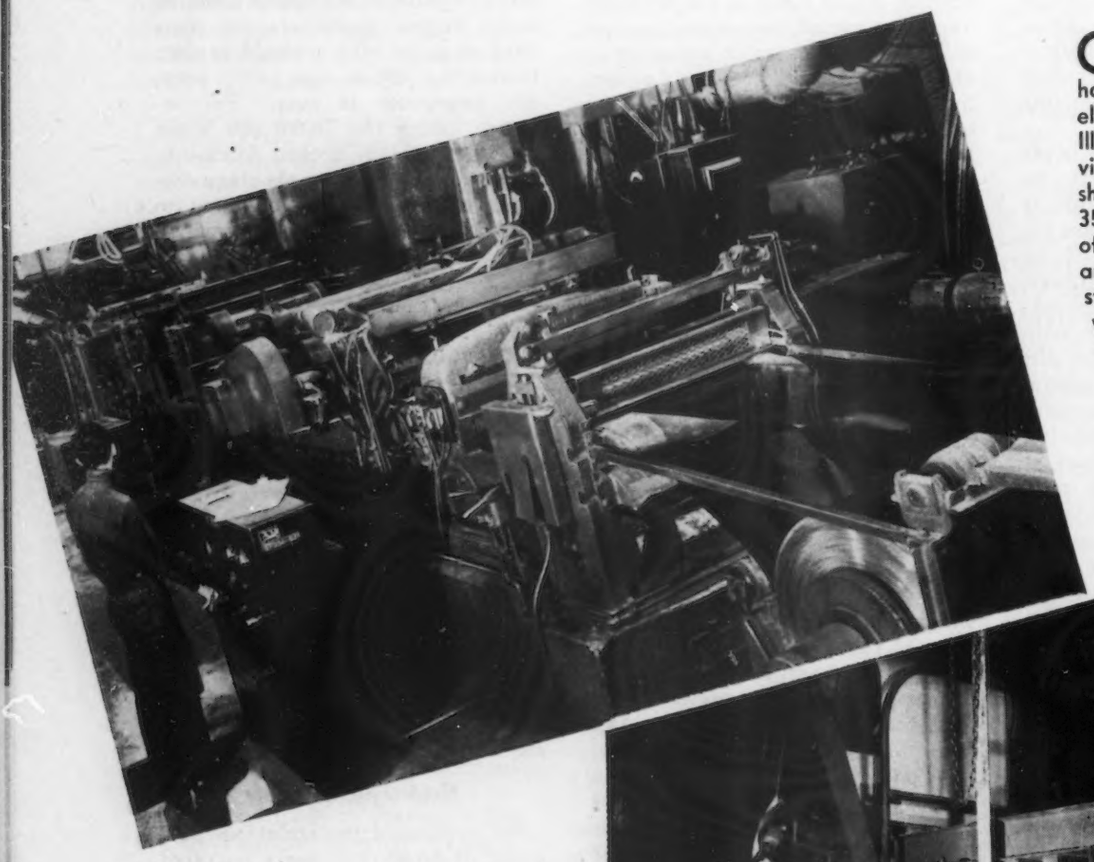
(10) Every indication is that the 1942 pack of primary foods in the United States will surpass any previous year. The Department of Agriculture has set production goals on certain fruits and vegetables that are expected to bring in record crops. No limit will be set on cans available for these foods, and it is expected that 1942 packs of tomatoes, snap beans, peas and corn will total over 125,000,000 cases, as against about 90,000,000 cases in 1941.

Electrolytic Program

To implement the ambitious program of 30,000,000 basis boxes of electrolytic plate in 1943, every major tin plate producer must naturally make extensive additions to existing coating facilities. Certain of the mills have plans still somewhat in a state of flux, as regards design of equipment and electrochemical technique, but by-and-large it seems as if about 26 new units will be constructed. All these electrotinning lines will handle continuous strip of about 31 gage in widths ranging up to 36 in. Speeds will be all the way from 200 ft. per min. up to 650 ft. per min.; 1000 ft. per min. is mechanically possible, but current densities in the plating tanks must be pushed so high as to result in either boiling the electrolyte or requiring elaborate cooling systems. Or, with certain electrolytes very high current densities may result in spongy deposits. Predicating capacities on a tin weight of 0.5 lb. per basis box, the individual lines will have yearly outputs of from 750,000 boxes to 1,500,000 boxes. Of course it is technically possible to run plate through with coatings considerably under 0.5 lb. per box, as for instance 0.1 lb. per

Ferrostan—Pacemaker of Acid

OVER 3,000,000 base boxes of 0.5 lb. electrolytic plate have rolled off this continuous electrotinning line at Carnegie-Illinois' Gary plant. These first views of this very compact unit show 32-in. strip moving at a 350 ft. per min. clip. Economics of this unit are very favorable, and nine more Ferrostan installations are building, which will incorporate features developed on this line. The new lines will be slightly longer than 140 ft., will plate at over 500 ft. per min., and may have melting equipment.



ABOVE

FEEDING end of the 140 ft. electrotinning line. Steel strip is feeding from one of two uncoilers (right), thence into shear, seam welder, looping pit, roller guide, drag bridle, electrolytic pickler, brushing machine, and then into the tin plating batt (extreme left).

o o o

RIGHT

ACID tin plating bath. New tin anode hanging by chain hoist, used anode on floor. Strip can be seen passing vertically in the tanks, of which there are four, each 5 ft. in depth. Note circulating system for electrolyte. Plated strip may be seen at upper left.

Tinning Lines

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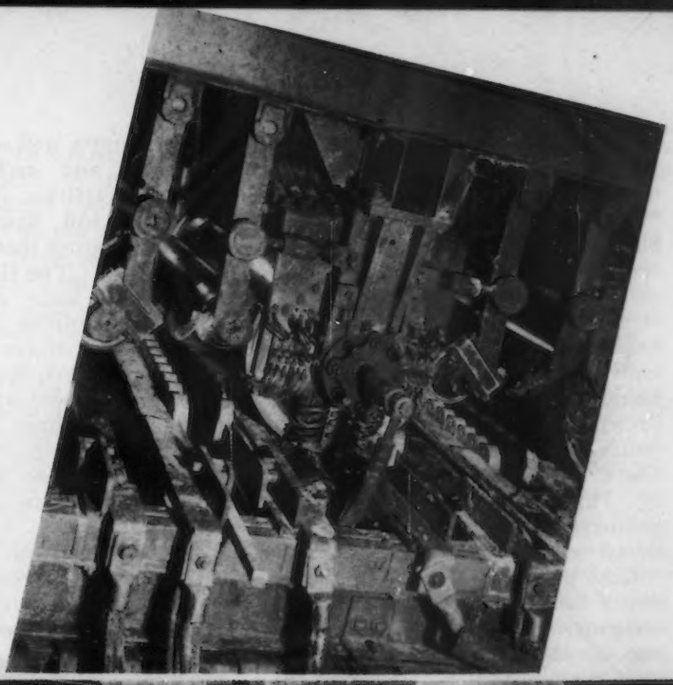

RIGHT

CLOSE-UP view of section of the tin plating unit. Strip is passing down one tank (right) and up through adjoining tank (left). Note electrical contacts on the copper rolls, and tops of the many tin anodes hanging in the bath chamber.

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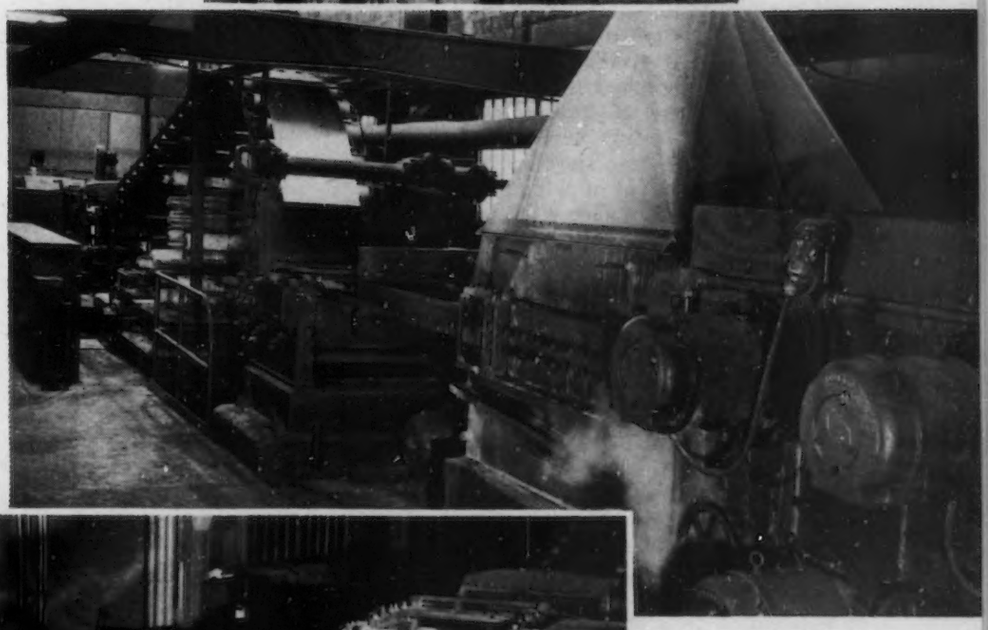

RIGHT

AFTER tin plating the strip passes through the dragout system (right) of high pressure sprays and squeegee rolls, thence through the wire brushing unit, steam dryer and drive bridle.

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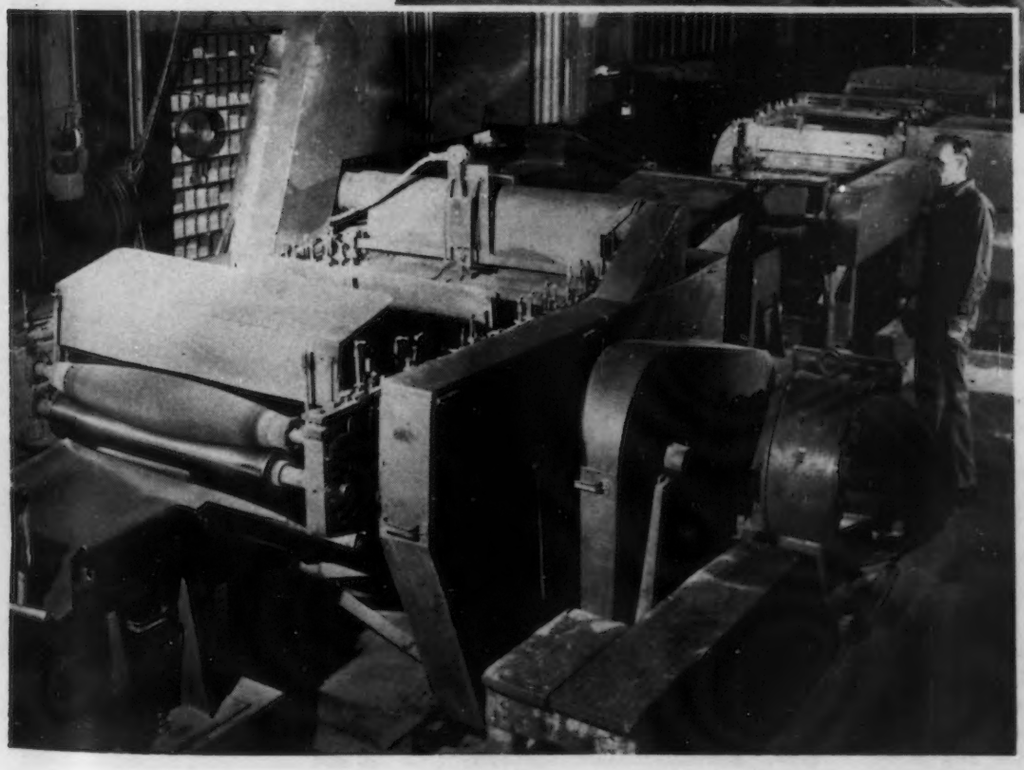

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LEFT

DELIVERY end of the line, with plate piling up at extreme left. Shown here are the upcut shear (right), roller leveler, flying shear, branner, and piler. The branner adds a slight surface oil film. The entire unit is one compact system, with cleaning, plating and shearing carried out continuously and at high speed.

o o o

box. A moderate amount of such light plate may actually be turned out in 1943.

For the chemical treatment of black plate, there are still some uncertain spots in the program. Present plans, however, indicate a total of about 21 chemical treatment lines. Some of the lines will treat individual sheets on a continuous basis, and others (such as the Crown Cork pilot unit) will treat continuous strip. All the lines will use a patented process controlled by Parker Rustproof Co., and photographs of one such line are shown on these two pages.

Rust proofing or bonding treatments for steel, developed by this company, to effect a better bonding of the paint film with the steel surface and inhibit corrosion effected through porosity of this film, have served with distinction in the automobile industry and for many other types of fabricated articles. And, for this new task, Bonderite "K" has been specifically developed. Instead of dipping or spraying, the steel sheets pass through all operations—Bonderizing, rinsing, and drying—on a series of rubber rollers with the dual capacity of conveyors and applicators. Handling is entirely automatic from feeding to packing. This new material, just as in the case of Parkerizing, other Bonderizing and phosphoric acid treatments, must be lacquered to attain corrosion resistance. For use in sanitary cans it minimizes corrosion and has shown excellent lacquer adhesion.

Fairly elaborate equipment is required for Bonderizing, the cost of application is pretty high, and the material must naturally be lacquered on both sides. A Bonderized film (thickness is about 0.0003 in.) cannot be soldered, seems to be definitely limited for packing mildly corrosive foods, and has limited fabricating properties. These factors confine its use to end stock. Phosphoric acid treatment seems to be less satisfactory than Bonderizing, and other films—as for instance, combination chemical treatments of phosphates, chromates, or borates—appear ineffective as to rust prevention or lacquer adhesion; rust prevention or lacquer adhesion; however, these points have not yet been definitely determined.

The electrotinning program will cost the industry something in the neighborhood of $32,000,000, and the chemical treatment lines will aggregate about $8,000,000 — the total of $40,000,000 ain't hay, even today. And, since these new facilities are pretty well scrambled both physically and technically with existing activities, many of the companies will finance the new equipment rather than request Government aid. The Government, of course, will issue certificates of necessity assuring amortization. And, although makers of electrical and mechanical equipment are loaded to the scuppers with war work, these tinning lines now carry a priority sufficiently high to assure completion of many of the lines by early fall and all the lines within 12 months.

The breakdown of electrotinning and chemical treatment units among the various tin plate producers is about as follows:

United States Steel Corp.

Original installation at Carnegie-Illinois' Gary tin mill has been in operation for five years, turning out over 3,000,000 boxes of plate, used extensively in dry packs and as can ends in experimental wet packs. A total of nine new units will be built; three for Gary, three for Irvin at Pittsburgh, and three for Fairfield plant of Tennessee Coal, Iron and Railroad Co., at Birmingham. A total of six new chemical treatment lines will be built, two each for Gary, Irvin and Fairfield. One pilot chemical treatment line already in operation at Gary.

Crown Cork & Seal Co., Inc.

One line in operation at Baltimore for about a year, the product heretofore going exclusively for bottle crowns and glass closures. Another faster unit practically completed. One new continuous chemical treatment line being developed.

Crucible Steel Co. of America

One 20½-in. line in operation for about five years at Midland, Pa., the product going for both specialty applications and general line cans. New 36-in. line soon to be built.

Bethlehem Steel Co.

Three electrotinning lines and two chemical lines to be installed at Sparrows Point, Md.

Inland Steel Co.

Two electrotinning lines and one chemical line to be installed at Chicago.

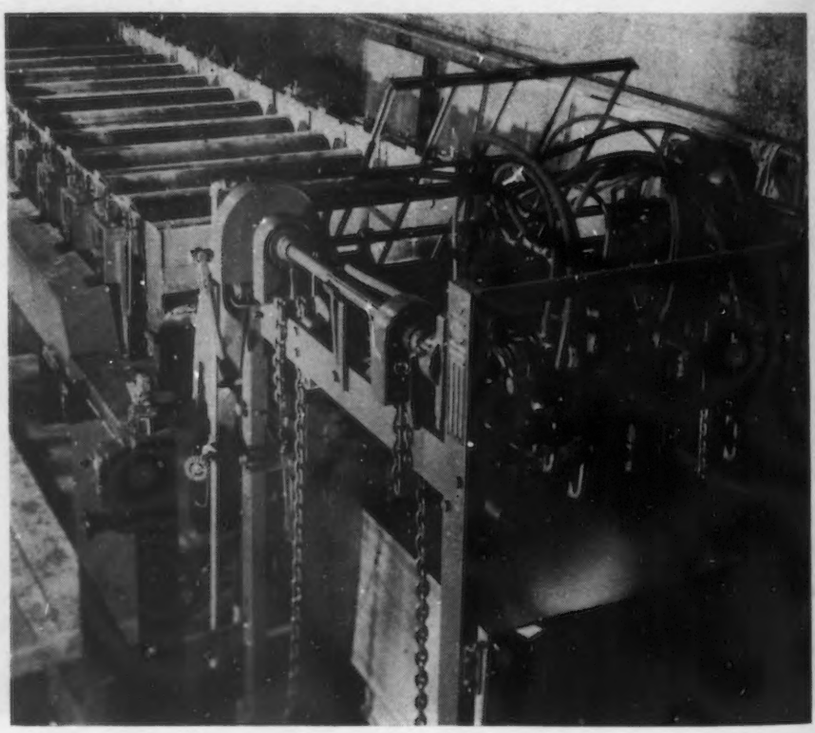
Weirton Steel Co.

Two electrotinning lines and two chemical lines to be installed at Weirton, W. Va.

Youngstown Sheet & Tube Co.

Two electrotinning lines and two chemical lines to be installed at Youngstown.

Continuous Bonderizing at the Gary plant of Carnegie-Illinois. This is the start of the line, with the Dexter feeder in foreground handling the stacked black plate at a 120 ft. per min. rate. The plate runs through rubber rollers (background) immersed in Bonderite "K" chemical for 7 sec. (at 155 deg. F.), then through cold water rinse, then through chromic acid (at 185 deg. F.)



Jones & Laughlin Steel Corp.

Two electrotinning lines and two chemical lines to be installed at Pittsburgh.

Republic Steel Corp.

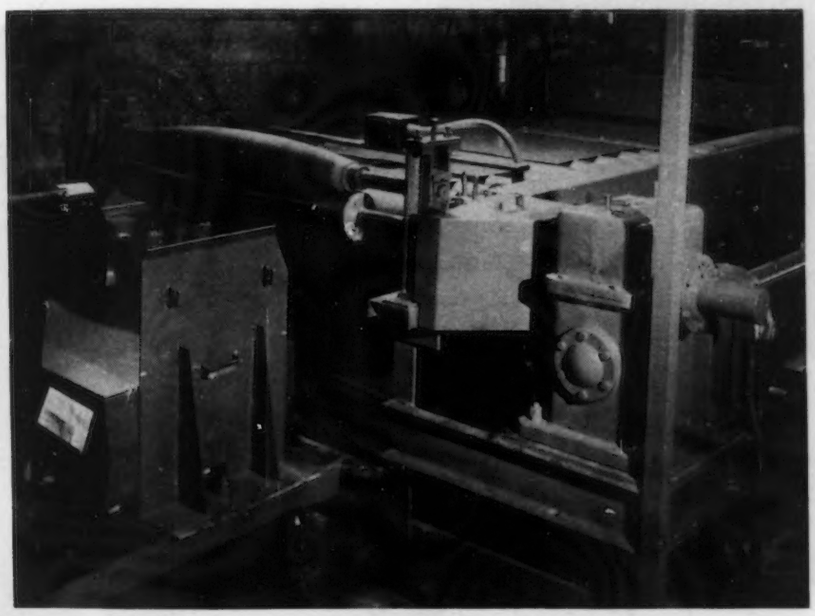
Two electrotinning lines and two chemical lines to be installed at Niles Works in the Warren, Ohio, district.

Wheeling Steel Corp.

One electrotinning line and one chemical line to be installed at Wheeling.

Granite City Steel Co.

One electrotinning line and probably one chemical line to be installed at Granite City, Ill.



Bonderized Black Plate passes from the rubber rolls in the chemical tank into rinsing and drying units and emerges onto an inspection table (shown here) and is stacked. The fine grained phosphate coating (70 mg. per sq. ft.), when lacquered or enameled, is successfully used in bending, crimping, lock-seaming and other can-making forming operations. Bonderite sludge settles out in tank, and new chemicals are constantly injected into the system.

Not mentioned, of course, are some continuous electrotinning lines for narrow strip, as for instance strip 4 in. to 15 in. wide used for specialty applications rather than for canning. There are some half dozen such lines scattered over the country, as for instance one at Thomas Steel Co., one at American Steel & Wire Co., the serpentine pilot line (for plating one or both sides of a strip) in operation at Weirton Steel Co. several years ago, and one building at Sharon Steel Corp. The mechanical and electrochemical problems encountered in such narrow lines are in no way comparable with the wide, high speed lines plating light coats of tin, of which this article is concerned.

Solutions to the mechanical problems encountered in wide, high speed lines probably require greater ingenuity than do the electrochemical problems. Nonetheless, a great deal of effort has been expended on the various tin plating baths (electrolytes, current densities, temperatures, additive agents, anode positions, etc.), and all the electrotinning lines to be built can be classified roughly according to the plating system employed. For instance, the United States Steel Corp. uses an acid bath, and the Wheeling line is licensed under this system. Crown Cork & Seal Co., Inc., uses an alkaline bath, and licenses have been extended to Inland, Bethlehem, Youngstown Sheet & Tube Co., Granite City Steel Co. (Stanelec; stannous = tin + electrolytic), and Jones & Laughlin Steel Corp. United Engineering & Foundry Co., working in cooperation with Hanson-Van Winkle-Munning Co. uses an acid bath, and will build two lines for Weirton Steel Co. (Weirite Electrolytic Tinplate). What system Republic will use, or what will be several new units for Britain, so far have not been settled. Crucible Steel Co. of America flash coats tin with an alkaline bath and follows this with heavier coating in an acid bath, probably of the sulfate type. J. S. Nachtman favors the fluoride bath, and previously used such a bath at Thomas Steel Co. and employs a similar technique in the narrow line now under construction at Sharon Steel Co. A newcomer, E. I. du Pont de Nemours & Co., has announced a plating bath for strip, designated as the halogen tin process (slightly acidic). The company claims that strip steel for containers can be tin plated twice as fast with less electric power by this process as by the "alkaline" electrotinning method, thereby reducing costs, etc. This is rather a confusing comparison as considerably more enters into the problem than current cost. Du Pont claims that tin deposited by the halogen method can be heated without discoloration either when the tin plate is heated to obtain the bright finish required by some can manufacturers (i.e., thermal reflowing, rather than mechanical brushing), or when treated (i.e., baked) during the process of applying lacquers or enamels.

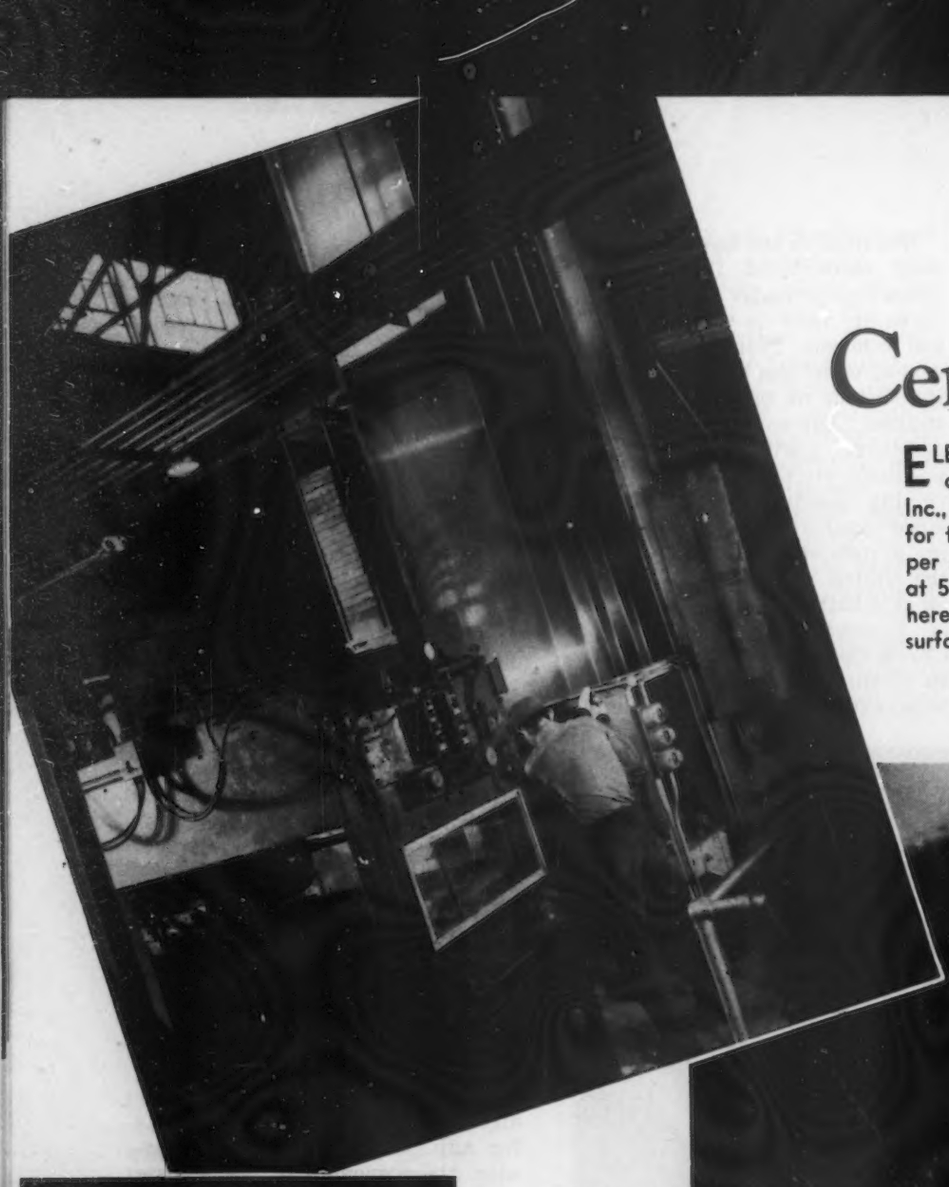
Electrolytic Technique

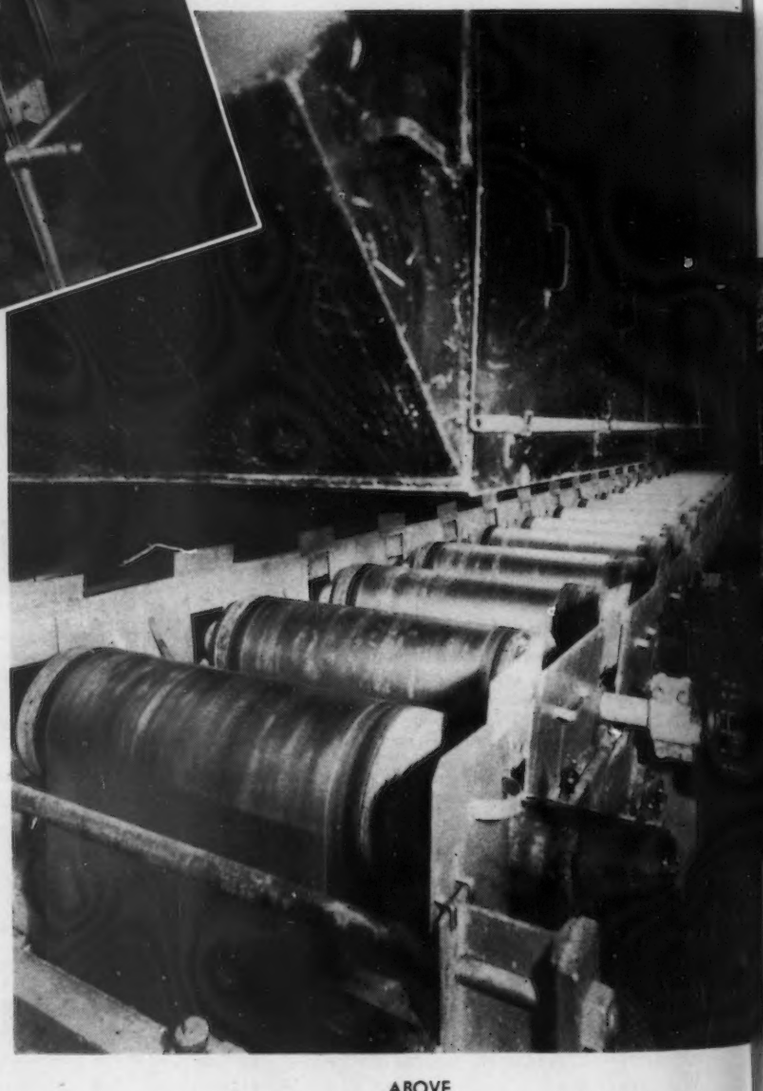
Being large, complex and costly (approximately $1,000,000), the continuous electrotinning unit for wide strip, like the continuous rolling mill, must consistently deliver a quality product at relatively very high speed with few interruptions for adjustment or repair. Otherwise, the economics of the process would be formidable. Some very wicked mechanical handling problems are introduced as, for instance, guiding of the strip and control of tension. High-speed pickling almost to perfection is necessary. Also long lengths of strip must be passed through electrolytic cells at a constant, uninterrupted speed of 250 to 650 ft. per min., all the time moving close to but at a constant distance away from many plating anodes which are, in turn, continuously going into solution and requiring individual adjustment and replacement (in certain installations). Constant bath temperature and bath analysis are vital. The electrolyte must be constantly agitated, and heated or cooled, as the case requires; and, simultaneously, its analysis must be maintained on the dot by frequent chemical tests and judicious adjustments. In certain units the solution to this problem seems to be a system whereby the electrolyte is constantly drawn from the cell to travel through auxiliary apparatus which continuously and automatically adjusts temperature and composition to within a small tolerance.

Constant voltage is also most vital, which is particularly difficult

Cemcoat—Pace-m

ELEVEN faster lines are being built, modeled after this unit at Crown Cork & Seal Co., Inc., Baltimore. The electrolytic line shown here for the first time handles 32-in. strip at 350 ft. per min., and the new lines will take 36-in. strip at 550 ft. per min. A separate unit, also shown here, is used for thermally re-flowing the tin surface on that plate requiring the hot-dip type of finish.





ABOVE

LINE starts with uncoiler (off to left), feeds strip into seam welder (center), through pinch rolls, then threaded into vertical 8-strand slack producer (right), and from there into a sulphuric acid, still tank, 18 strand pickling unit.

o o o

LEFT

THE tin anodes are sizable hunks of metal, 7 ft. long and weighing over a ton. They are cast at the plant of comparatively pure metal, and are stripped and replaced in the bath about once a month. The new lines carry about 48 tons of tin anodes.

ABOVE

LOOKING down the top of the tin plating tank, showing the strip entering (left), thence over and under rolls spaced about 12 ft. apart vertically. This tank is made up of 16 passes, or 32 vertical strands, between each of which is a one-ton anode. Each top roll carries power.

maker of Alkaline Tinning Lines

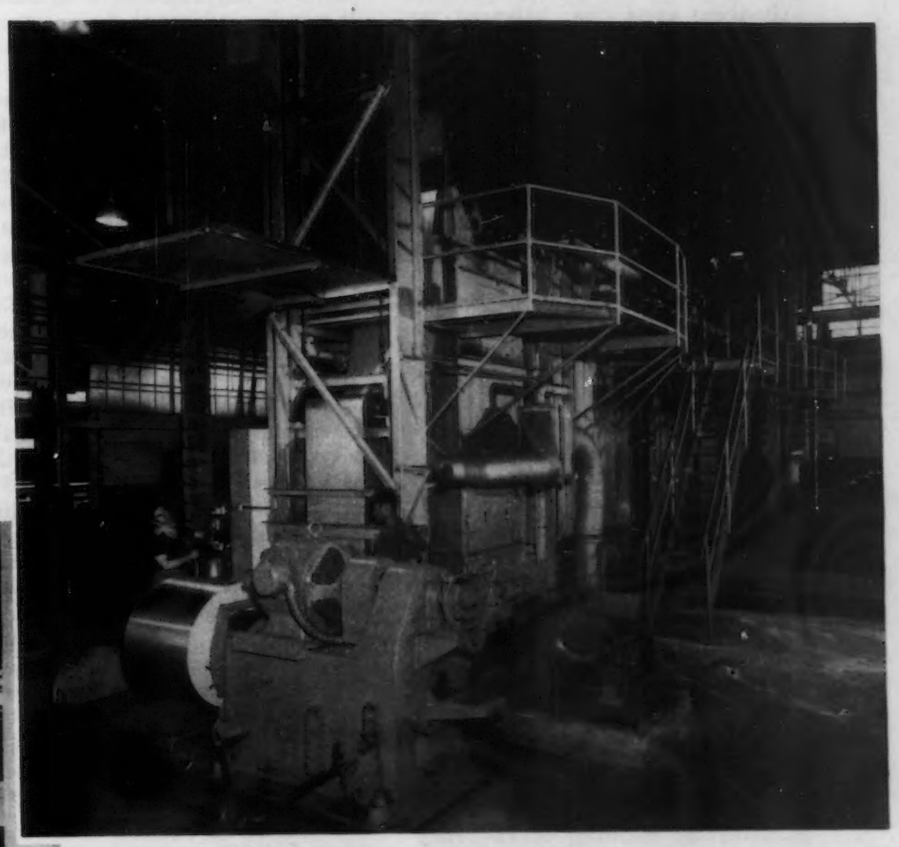
RIGHT

PLATED strip (silvery, semi-bright) goes through simple dragout and washing system, thence into vertical 2-strand slack producer (left center), and is coiled (left). Overall length of entire line is 120 ft.

o o o

BELOW

FEEDING end of brightening line. Coiler (right) feeds strip into pinch rolls, then into 4-strand slack producer, and up through vertical gas-fired, radiant tube heating furnace (left) in which tin is melted and flowed over steel surface, then rapidly water quenched.



RIGHT

DELIVERY end of brightening unit showing vertical furnace at the right, 6-strand slack producer (center), and winding reel (left). The speed of this unit is about 250 ft. per min., and the finished product has the typical mirror finish of hot-dip plate.

in view of the high current densities involved (sometimes 200 or 300 amp. per sq. ft.), and the anode metal is frequently perverse in going into solution more or less rapidly than metal is being plated out. There even are instances when current conditions are so critical that the variation in resistance of bus bars due to room temperature changes must be balanced by minute regulation of current delivered to the cells.

The electrochemistry of tin plating in general has shown a progressive development since the first World War. Tin—like copper and zinc—may be plated for industrial purposes from either an alkaline or an acid solution. In general, the plating of tin from an alkaline solution has found applications for the coating of articles of complicated shape where a high throwing power is required. The bath is operated hot (say 170 deg. F.), and while this has certain drawbacks, it also has the merit that it assists the cleaning of the basis metal, as the hot alkaline solution is an active detergent. For the continuous electrotinning of steel strip, however, it is frequently stated that these special merits of the alkaline bath are of no great importance as a flat surface is involved so that it is possible to make arrangements to insure uniform covering with the tin deposit, even with a bath of only moderate throwing power; also, in a continuous process it is easy to make adequate provision for the satisfactory cleaning of the steel prior to plating. Parenthetically, it might also be mentioned that the alkaline bath has higher bath voltage and more than double the cathode current density of an acid bath for the same tin deposition.

The *alkaline* tin bath has a long history. Industrial development of tin plating first started with the introduction of a plating bath by Roseleur in 1850, which consisted of an aqueous solution containing a very low concentration of stannous chloride and a relatively high concentration of sodium pyrophosphate. This type of solution was used extensively during World War I, when coatings of tin found a variety of applications to prevent the direct contact of steel, brass, etc., with certain explosives. A drawback to the use of these solutions is the fact that tin is present in the bivalent form as stannite, which tends to oxidize to stannate, and when this occurs there is deterioration in the quality of the deposit. Although this tendency to oxidation may be suppressed partially by the presence of reducing salts, e.g., sodium thiosulphate, etc., in comparison with the solutions used for the electrodeposition of other metals, such as copper and nickel, the alkaline stannite tin bath was inferior as regards stability, as well as suitability, for the production of deposits of any reasonable thickness. It was found later that more promising results could be obtained with an alkaline stannate bath.

Only about ten years ago was it realized that tin can be deposited in a smooth, compact form in the latter type of solution. Why this had not been recognized previously was probably due to the fact that a very small proportion of tin as stannite in the solution is sufficient to cause the production of deposits of spongy tin. With tin anodes operated under normal conditions, some bivalent tin almost invariably enters the solution, thereby causing deterioration of the deposit. Methods of overcoming this defect of the bath were, however, possible and a number were developed. These initially consisted in providing conditions that would insure rapid oxidation of any stannite to stannate. Thus, Oplinger and Wernlund[2] adopted the procedure of making periodic additions of such oxidizing agents as hydrogen peroxide or sodium perborate. Another method[3] which was proposed later consisted in the use of insoluble anodes which continuously maintained oxidizing conditions in the bath and thereby insured the absence of stannite ions. This latter method, however, involved depletion of the tin content of the bath and necessitated as an adjunct a method of regeneration of the solution to maintain the metal content. But the most effective method of operating a stannate solution had been foreshadowed already by earlier work carried out by Foerster and Dolch[4] and Naf[5], which indicated that under certain conditions at the anode it is possible to insure that the tin will dissolve entirely in the quadrivalent form.

On the other hand, the development of the *acid* tin bath in which tin is present entirely in the bivalent form is comparatively recent. The particular difficulty that had to be overcome with this type of bath is a pronounced tendency for tin to be deposited at the cathode in the form of isolated crystals which, upon continued deposition, produce long needles. However, a similar difficulty had existed in the electrodeposition of lead from a bivalent lead acid bath, and this had been overcome in the Betts' process for electro-refining of lead which was introduced in 1902. In this process an acid lead fluosilicate solution was used which, with periodic additions of glue to suppress crystal growth, gave compact deposits of the metal.

When a demand arose for electrorefined tin in the U. S. A. during World War I, the method used for the electro-refining of lead was adopted.[6] An acid tin fluosilicate bath was employed to which periodic additions of glue were made. This proved successful, and was applied on an industrial scale between 1915 and 1917. It definitely established the possibility of obtaining compact deposits of tin from acid solutions. Much work was carried out to improve the original solution. Initially, this was devoted to the introduction of improved addition agents to suppress preferential crystal growth. F. C. Mathers[7] in the U. S. A., and M. Schlotter[8] in Germany, were prominent in this work. In 1917 Mathers recommended additions of cresol while Schlotter in Germany was experimenting with additions of various cresols and phenols. The American Smelting and Refining Co. adopted the use of cresol, which was added in the form of an emulsion as a supplementary addition to glue to the tin bath. About the same time a portion of the combined and free hydrofluosilic acid in the bath was replaced by stannous sulphate and sulphuric acid.

An important development in electrolytic refining occurred between 1920 and 1923, when the remainder of the combined and free hydrofluosilicic acid was replaced by cresolsulphonic acid.

[2] *F. F. Oplinger and C. J. Wernlund and E. I. du Pont de Nemours & Co. U. S. Patent 1,919,000, 1933. Also du Pont Patent 1,841,978.*

[3] *A. W. Hothersall, S. G. Clarke and D. J. Macnaughtan, "The Electro-deposition of Tin from Sodium Stannate Solutions with the use of Insoluble Anodes," J. Electrodepos. Tech. Soc., 1934; Tech. Publ. Internat. Tin Res. & Dev. Council, Series A, No. 1.*

[4] *F. Foerster and M. Dolch, Z. Elektrochem., 1910, 16, 599.*

[5] *E. Naf, "Versuche zur Theorie der Weissblechentzinnung," Dissertation, Dresden, 1911.*

[6] *R. L. Whitehead, U. S. Patent 1,157,830, 1915.*

[7] *F. C. Mathers, U. S. Patent 1,397,222, 1921.*

[8] *M. Schlotter, British Patent 148,334, 1917.*

This appears to have resulted from investigations by Alexander and Stack,[9] of the American Smelting and Refining Co. In 1923, when the industrial electro-refining of tin ceased, the composition of the solution in use was 30 gm. of tin per liter, 80 gm. sulphuric acid, 40 gm. cresolsulphonic acid, with daily additions of glue and cresol.[9]

[9] *W. H. Alexander and J. R. Stack, "Reduction and Refining of Tin in the United States," Trans. Amer. Inst. Min. & Met. Eng., 1924, 70, 404-440.*

Modifications have been in respect to the amount and nature of the sulphonated aromatic hydrocarbon used, e.g., sulphonated phenol, benzol, naphthalene, etc., by Schlotter and others,[10, 11] instead of sulphonated cresol. The price of these products in various countries frequently dictated which would be used. Additions of glue have been maintained, while a supplementary addition agent has continued to be used, and this in general has been cresol or other coal or wood tar distillation product, although lately other organic compounds of high molecular weight have been suggested.

Ferrostan Installation

On the basis of performance to date, the United States Steel Corp. (Carnegie-Illinois) Ferrostan (ferrum = iron + stannum = tin) installation at Gary warrants the first detailed description of existing and planned commercial wide strip plating installations. A great deal of experimental work has been carried out on this Ferrostan unit, but usually it has worked steadily 8 hr. a turn, 20 turns a week, turning out approximately 1100 base boxes of plate per turn, and a total of well over 3,000,000 base boxes in over three years of operation. The black plate varies from 26 in. to 32 in. in width and is usually 31 gage.

Photographs of the Gary unit are shown on pages 32-33. The entire equipment assembly is about 140 ft. in length and consists of the following units: two uncoilers (coil weight is about 6000 lb.), shear, seam welder, looping pit, roller guide, pin hole detector and flying micrometer, magnetic drag bridle (tension = 600 lb.), electrolytic pickler (10 per cent H_2SO_4, at 200 amp. per sq. ft.), tampico brushing machine, tin plating bath, drag-out recovery system of sprays and squeegee rolls, wire brushing machine, steam dryer, drive bridle (a glorified pinch roll, tension being about 1900 lb.), up-cut shear (cuts out welds, badly pinched and broken plate), roller leveler, flying shear (cuts to plate length = 1/32 in.), branner, and piler.

The tin plating bath is a phenolsulphonic acid solution with glue additions and other additions, which is based on the Schlotter patents.[8, 10, 12, 13] The bath is mechanically interesting in that it is a vertical (see photographs) four-pass plater, each pass being 5 ft., the total therefore being 20 ft. Current density in the first pass is 200 amp. per sq. ft., and the other three passes carry 175 amp. per sq. ft. The plating solution is circulated and the temperature is accurately controlled (usually by cooling) to 110 deg. F. Individual tin anodes are about 5 ft. in length, and it is most important to note that the anodes can be changed while the unit is in operation. Also interesting is that anodes can be cast from scruff tin (off the tin pots in the hot-dip house) and therefore carry some iron. This iron, however, goes into solution and will not plate out of an acid bath.

[10] *M. Schlotter, British Patent 443,429, 1936.*

[11] *R. R. Pine and Harshaw Chemical Co., U. S. Patent 1,987,749, 1935.*

[12] *United States patent No. 1,824,100, Sept. 22, 1931. Max Schlotter, probably the Continent's most famous electrochemist, also patented many important features of bright nickel plating, which process has found wide popularity here in the past several years. All American rights to the Schlotter tin patents are now held by the United States Steel Corp. R. E. Zimmerman, v. p. in charge of U. S. Steel research was one of the first to perceive the value of these patents to commercial tin plating, along with J. C. Whetzel and George Totten of the same company. Original experimental work was carried to a successful conclusion by E. S. Taylerson, of Carnegie-Illinois research at Pittsburgh. Since the war Germany has prohibited the production of hot-dip plate. There are at least several electrolytic tin plating plants operating under the Schlotter patent. One is at Brown-Bovari at Baden, which is nothing more than a small laboratory plant used more for wire than for strip. Another is in the plant of Wolff (Germany's largest tin plate maker) at Rasselstein-Andernach in the Rheinland. This also is only a small plant and probably cost no more than $10,000. Can plate four to six 4-in. strips at one time, or perhaps one 16-in strip, at a speed of 33 ft. per min.*

[13] *During the past three years Carnegie-Illinois has developed many mechanical devices, on which four patents have been issued and 17 are pending.*

The equipment originally handled strip at about 50 ft. per min., but now the speed is about 250 ft. per min., and this is soon to be lifted to 350 ft. per min. The plating efficiency is kept very near 100 per cent. The bath has a capacity of about 3850 gal., tin concentration is 31 gm. per liter, and the acid concentration is about 28 gm. per liter. Glue and other additions are made to the bath to improve the brightness and structure of tin deposits. The tin can be plated with a mirror luster, but this finish is commercially undesirable as it is rather brittle, and shows abrasion marks, finger prints, etc. Therefore, the metal is usually plated dull and subsequently mechanically brushed to a satin finish. The porosity[14] of the brushed plate is actually considerably better than the plate as deposited—due apparently to the slight burnishing action which does not remove any of the tin.

The tampico brushing machine (following pickling) scrubs both sides of the strip, the water flow on the brushes being very liberal to assure no carry-over of acid into the tin bath. The dragout recovery system (following plating) has high-pressure jets to wash off all dragout, the acid of which is recovered and concentrated. The scratch brushing machine has metal brushes made of fine nickel silver wire. In view of the fact that this brush is working on a relatively soft tin film only 0.00003 in. thick, it is not too surprising to discover that it is the most accurate piece of equipment in the entire line. During early runs there was considerable grief until this was properly developed. A precision brushing operation is possible only by virtue of the continuous honing of the brush against a stone so that it is maintained truly cylindrical at all times.

Considerable effort was expended on the steam dryer, also. The continuous strip is first hit with low-pressure saturated steam which condenses on the cold plate. It is then hit with successive steam jets, and as the strip emerges from the chamber the surface water film is flash evaporated by the heat of the strip.

Inasmuch as electrotinned plate carries no palm oil on the surface, it is desirable to add an oil film in most instances to lubricate the dies during can fabrication. Therefore, the branner carries a little palm oil to impart this oil film, which is the reverse of the branner in a hot-dip

[14] *Little mention is made herein of relative porosity of hot-dip and electrolytic plate, frequency of pin holes, ratings in hydrogen evolution test, etc. Much discussion usually centers in this problem, not a little of it seemingly somewhat academic in view of great increase in porosity of all plate due to scratches, bruises in can making machinery, handling in general.*

installation, the latter serving to take off most of the excessive oil film carried by the plate.

Brushing, and Melting

As mentioned, the Gary unit can plate mirror-finish tin, but the preference is to plate a matte finish and brush it up to a satin finish mechanically. However, in certain directions there is a tendency in favor of the fused finish of hot-dip plate. Therefore, Carnegie-Illinois (as have other plants) has developed a very efficient method of melting the electro-deposited tin, thereby producing a surface closely akin to hot-dip plate. At the high speed of up to 500 ft. per min. the plated strip undergoes an electrical-resistance flash treatment in a furnace serving only to bring the steel surface and the tin film up to the melting point of tin. The tin floods the surface momentarily and is quickly quenched. The Crown Cork & Seal line reflows the tin in a gas-fired radiant tube furnace (see photos on page 37). J. S. Nachtman at Sharon Steel, and Crucible pass the plated strip through a hot oil bath at a high enough temperature to melt the tin and then follows this by quick quenching in cold oil. A combination of mineral oil and vegetable oil was first tried by Nachtman, but this was later discarded in favor of a mineral oil which has been described as a Pennsylvania type of engine oil with a flash point of about 650 deg. F. Palm oil is considered very satisfactory by Crucible and is used for all brightening at Midland. Back in 1931 when Thomas Steel Co. started a 20-in. tin plating line, under the direction of J. S. Nachtman, brightening was carried out by skin passing in a rolling mill with heated rolls. The product went into specialty applications, not into canning. The Germans also seem to favor brightening by rolling, although German set-ups are in no way comparable to the American installations described herein.

Crown's Cemcoat Line

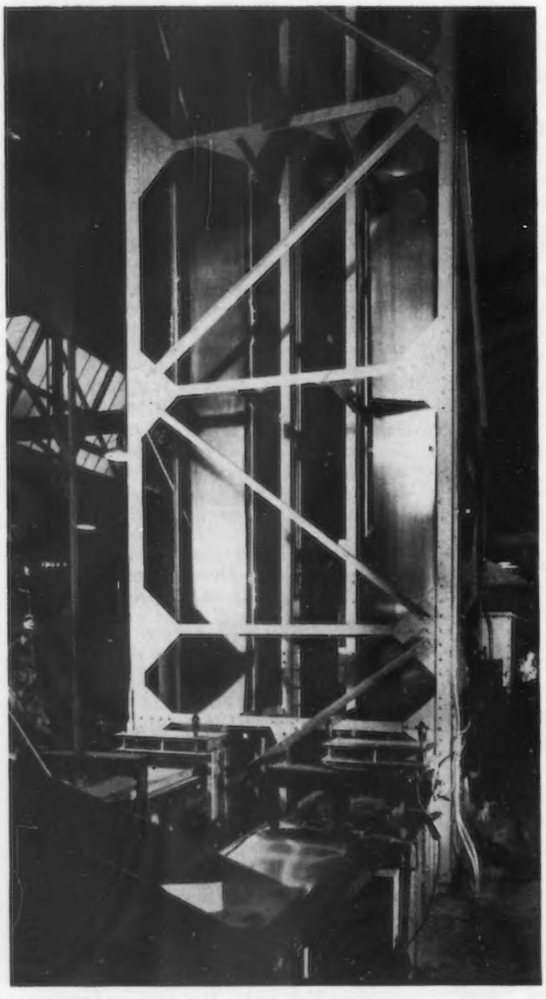
Ranking with the Gary tinning line of Carnegie-Illinois as regards a history of successful commercial operation, is the electrolytic line of Crown Cork & Seal Co., Inc., Baltimore, which has been in operation for about a year and has turned out over 1,000,000 base boxes of plate, varying in coating weight of 0.3 to 0.7 lb., depending on the final application of the product.

Crown, of course, occupies a particularly unique position in the tin plate picture, being a consumer of steel rather than a producer. Some six years ago Crown put in a continuous cold mill, and by buying hot bands from Bethlehem became to a great extent self-sufficient as regards steel requirements. Along with the cold mill, hot tinning facilities were installed, and several years later an electrolytic coating program was initiated, the exploratory work being carried out on a small pilot unit of full width (i.e., 32 in.).

As has been the case in numerous other instances, Crown's sanguine president, C. E. McManus, displayed a striking amount of vision, initiative and persistence, in having faith in electrolytic tinning and in pushing a unique practice to a highly successful conclusion. And, there is something just a little paradoxical in five prominent producers of steel coming within recent weeks, to Crown, a consumer, to obtain the rights to use the Crown electrolytic system.

The Cemcoat (C.E.M cManus + coat) line has been engineered throughout by William B. Cooper, Crown's chief electrical engineer. And, quite obviously it is very efficient and fool-proof.

Unlike competitive equipment, the Cemcoat line employs an alkaline tin plating bath. The exact constitution of the bath is guarded by the company, but the writer would guess it to be some variation or modification of the sodium stannate-acetate electrolyte. Such solutions are economical, essentially simple to handle and control, are only mildly corrosive and, therefore, are not hard on equipment, and turn out dense, smooth, white plate. The maintenance of the proper free caustic soda content is highly important to obtain balanced anode corrosion. No brightening agents are added to the bath. Excellent results may be produced over a wide current density range, as for instance 15 to 30 amp. per sq. ft. Higher current densities may be used provided the temperature is



TWIN slack producer on the feeding end of the Crutin line. The top roll of this unit can be moved up or down to take up or to feed slack during coil changes. From here the strip passes into a pickling unit, thence a short, horizontal alkaline tin plating unit, and a much longer horizontal acid tin plating tank (horizontal anodes on both sides of strip), thence into a hot oil re-flowing bath, and a cold oil quenching bath (patent 2,274,963), solvent cleaned to remove and recover surface oil, and coiled (see opposite page).

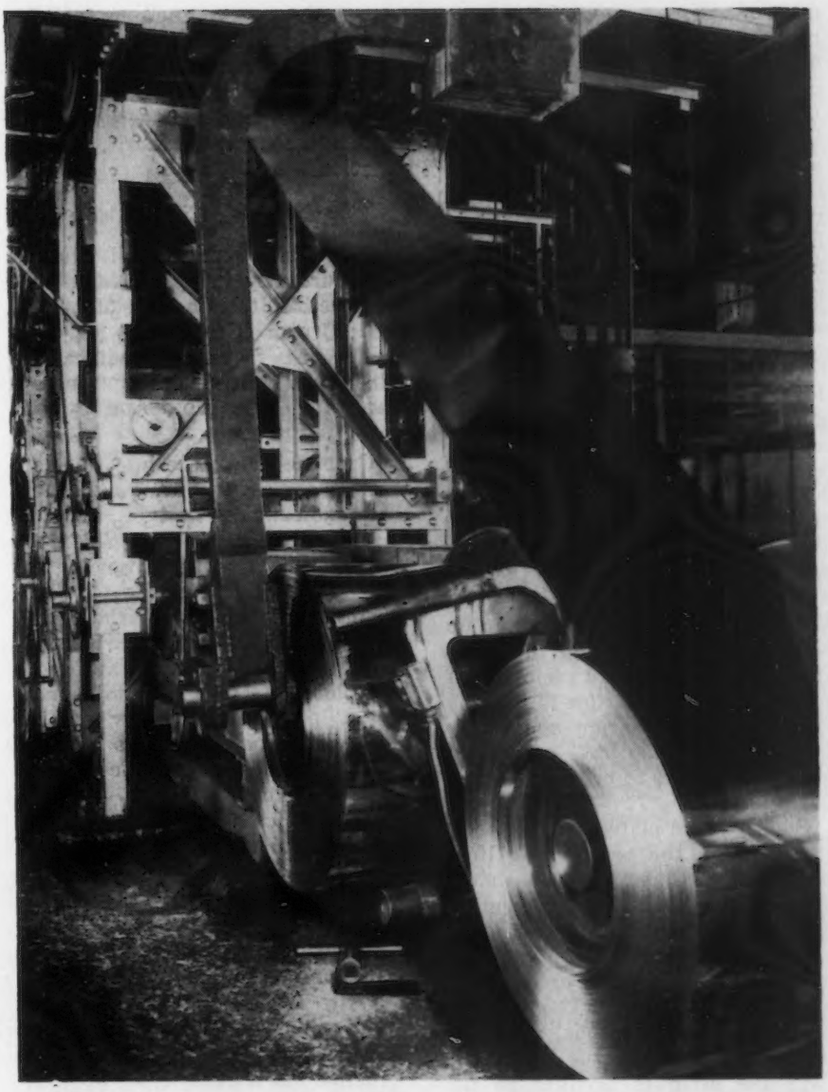
kept in the maximum rather than the minimum range, and the caustic content is carefully adjusted to meet the condition at hand.

The solutions are usually operated in closed areas, and under such conditions the evolution of hydrogen and vapor from the bath may become very objectionable to persons working in the vicinity of the solution, or in condensing cause rusting of the roof structure. This condition may be prevented by adding small quantities of sodium oleate or other soluble soap to the solution. One pint of soluble soap is enough for several hundred gallons of solution. This treatment causes the formation of a foam on the bath which prevents the dispersion of the fumes through the surrounding atmosphere. Or, frequently it is more simple to cover the tanks with exhaust hoods.

Irrespective of the fact that such an alkaline bath plates only half as much tin per kw-hr. as does an acid bath, the alkaline set-up is spiritedly defended on the basis of simplicity of equipment, excellence of results, a slightly lower initial cost, and the fact that current cost may not be of paramount importance, i.e., even in areas of high power rates, it is in the neighborhood of 60c. per ton, and may drop to half that figure in low-rate areas.

The Crown line is made up of three distinct units—the plating line, a brightening line, and auxiliary shearing equipment. Tin plate as it comes off the plating line has a quite beautiful satin, semi-bright finish, which finish is fully satisfactory for the bulk of the plate consumed in the Crown plant. Small quantities of plated strip are run through the brightening (or thermal reflow) line to duplicate the mirror (or fused) finish of typical hot-dip plate.

The plating line is 120 ft. in length over-all, and the pictures on pages 36-37 show many of the distinctive features of the equipment. Strip in widths up to 32 in. wide are handled at speeds on the order of 375 ft. per min., current density in the tin bath being 35 amp. per sq. ft., and temperature controlled (by adding heat through steam coils in the bottom of the tank) to 180 deg. to 190 deg. F. For a new line Crown is just completing for itself, and for the lines being built for other companies (with exception of Granite City), strip widths will be a maximum of 36 in., rate of travel will be 550 ft. per min. (by lengthening plating tank), and there will be more elaborate loopers (to handle more slack during coil changes).



DELIVERY end of the Crutin line. The plated and thermally re-flowed tin plate comes through a solvent cleaner, thence a looper, and down to the winding reel shown here. In case matte finished plate is desired, the brightening apparatus can be by-passed. This is a 20½-in. line, built about 5 years ago. Construction preliminaries have been initiated on a 36-in. line. Speed is about 250 ft. per min. on 0.5-lb. plate.

Starting with an uncoiler, the steel strip passes into an electric seam welder, through pinch rolls, back and forth through a vertical 8-strand looper, into a sulphuric acid still tank pickler (18 vertical passes) to clean and white pickle the steel surface, thence into the alkaline plating bath (16 vertical passes or 32 strands, each 12 ft.; the new and faster lines will have 24 passes, or 48 strands), through a water spray and squeegee rolls to remove the very sizable dragout, a final hot water wash and blower to dry the surface, another vertical looper, and finally to the coiler. The coiler builds up a tension of about 3000 lb. in the strip, although the new lines will control tension by drive and drag magnetic bridles. Inasmuch as water can be mixed with the alkaline electrolyte, the dragout can be simply drained right back into the plating tank; evaporation just about balances this dragout plus water addition. The tin plating tank is one continuous tank rather than compartmentalized, and no effort is made to circulate the electrolyte other than pumping from one end for filtering out sludge and returning the filtered electrolyte to the other end. Between each strand in the tin plating tank, there is placed a very large slab tin anode. These anodes (see photo on page 36) are cast in one corner of the electrolytic tinning room. They weigh on the order of 2300 lb. apiece, and the line is shut

down about once a month for stripping off all anodes and installation of new ones. Thus, there is a total of about 32 tons of tin anodes in the line, and the new and faster lines will carry about 48 tons. The anodes as cast are quite pure, although minor impurities are of no concern. Appreciable amounts of heavy metal impurities would be undesirable, however, as they would enter the deposit through the solution.

One very conspicuous feature of the Crown line is that no great effort is made to accurately side-guide the strip throughout the equipment. Rather, a quite clever arrangement has been devised to have the coiler float back and forth to follow all the minor lateral movements of the strip. The vertical loopers on each end of the line are also very compact and quite efficient in feeding in and taking up slack in the strip during the welding on of new coils and removing of plated coils. At no time is the line slowed down. The new and faster lines will naturally have even more elaborate loopers to permit continuous operation.

Some of this plated strip is then run through the brightening line, pictures of which are also shown on pages 36-37. This equipment is essentially a vertical gas-fired radiant tube controlled atmosphere furnace, the strip running up one side and down the other. The upward path is a reheating zone, and during a short period on the downward path the strip is brought to tin melting temperature, at which point the tin flows over the surface and alloys very slightly with the steel basis metal. The strip is quickly quenched in a water bath and then coiled. The speed of this line is on the order of 200 ft. per min., and may soon be lifted to 250 ft. per min. Naturally, control has to be quite accurate for otherwise the tin film might ball up or crystallize in an undesirable manner. All the new tinning lines being built will be supplemented with brightening lines, although the different producers will brighten various percentages of their plated strip, depending on the desires of their customers. Bethlehem, for instance, will brighten large percentages, and has six units building.

The supplementary equipment to shear and pile the strip into plate size is conventional in design, and is of no particular interest at this time. Whereas Crown prefers no oil on its plate inasmuch as most of it is immediately lacquered or lithographed, many of the new installations will have branners attached to shearing equipment, which will carry a little oil to impart a slight film to the plate and thereby facilitate subsequent can fabricating operations.

Crucible's Crutin Line

The third commercial tinning line currently in operation is that of Crucible Steel Co. at Midland, Pa. This Crutin (Cru cible + tin) has undergone several modifications since the initial description appeared in THE IRON AGE, July 2, 1936.

Crucible's entrance into tin plate manufacture in 1937, particularly the radically new type of electrolytic tin plate, occasioned much surprise. The move, however, was at the direct instigation of F. B. Hufnagel, Crucible's chairman, who at that time desired more product diversification at Midland and chose tin plate as the most stable new outlet possible. In view of the availability of continuous coils of black plate, Mr. Hufnagel concluded that continuous tinning was the most technically correct method of handling such material. And, inasmuch as continuous hot dipping had shown little promise throughout the years, he decided to carry out experimentation to perfect electrolytic deposition.

With but the one 24-in. single stand cold mill converting hot bands from an outside continuous hot mill, Crucible has a capacity of approximately 30,000 tons of cold reduced strip annually, of which over 1000 tons monthly has usually been diverted through the plating unit. In the near future Crucible expects to install new rolling facilities and a new plating unit to overcome the handicap of the narrow widths (20½ in.) available now. This expansion will provide sheets or coils up to about 36 in. in width, and plating line speeds are planned in the neighborhood of 500 ft. per min.

Crucible markets three different types of Crutin. Crutin Lite is the principal product and is, as the name infers, a tin plate with a thin or light weight tin coating on the order of 0.5 lb. per base box. Crutin Regular is a plate of heavier tin coating, say, 1 lb. per base box. Crutin Special is a tin-over-copper plate, carrying about 1 lb. of copper plus 1 lb. of tin per base box. This product is used in specialty applications, and in certain cans such as ether cans.

A very conspicuous feature of the Crucible line is the brightening treatment to which the electrotinned strip is subjected. This consists in fusing the coating in a bath of hot oil of suitable characteristics (developed in part by Colin G. Fink) and subsequent quenching in a cold oil bath. It is necessary in the brightening process to avoid mechanical contact with the tin coating while in a fused and softened condition, as this produces marring. This introduces special mechanical problems due to the necessity for feeding the strip over guide rolls into and out of the hot and cold oil baths.

Crucible's chief engineer John F. Ferm cleverly solved the problem by designing a unique piece of equipment (U. S. patents Nos. 2,141,382 and 2,192,303), made up of separate hot and cold oil tanks which are interconnected by a duct extending downwardly from the hot to the cold tank, and hence having an entry into the cold tank situated below its entry into the hot tank. This duct, although it provides direct liquid access between the hot and cold oil baths, nevertheless provides an effective seal between the two operating on the U tube principle, since the cold oil being of higher specific gravity than the hot oil, remains below the hot oil in the duct, which due to its downward inclination prevents the establishment of convection currents between the two baths.

The electrotinned strip enters the hot tank over a guide roll and passes thence, in a downwardly inclined straight line through the hot oil bath and interconnecting duct and into the cold batn and under a roll submerged therein, the strip passing thence upwardly and out of the cold bath between squeegee rolls which drain off the excess oil. During passage of the strip through the hot bath, the tin coating is fused and brightened, and is frozen and hardened as it passes through the duct into the cold bath, the submerged roll in which is sufficiently removed from the duct entrance to assure hardening of the coating and hence avoidance of marring, on contacting the roll. By virtue of this arrangement, the strip is not subjected either to mechanical contact or to atmospheric exposure while the tin coating is in a fused and softened condition. The resulting finish is mirror bright.

The hot oil tank is heated by electrical immersion heaters (to about 480 deg. F.), and the oil in the cold tank maintained at its appropriate temperature by continuous circula-

tion through a cooler over suction and pressure lines.

The moving strip tends to heat up the cold oil bath by virtue of the heat of the strip itself acquired in the hot oil bath and also the hot oil adhering thereto. To offset these effects, a counter-flow of cool oil is established in the duct by appropriately disposed pressure and suction lines extending to an oil cooler. This counter-flow is so regulated with respect to the strip speed as to maintain the cool oil seal in the duct and to provide a rapid quench which enhances the brightening.

As regards plating operations, Crucible uses both alkaline and acid baths, or a combination of the two. Smooth, bright and adherent coatings are obtained with the alkaline bath, but for reasons of economy, Crucible states a preference for the acid bath, or, as set forth in patent No. 2,274,963, from a "flash coating" alkaline bath followed by a heavier overcoating from an acid bath. The alkaline flash plate bath has a time interval of about 15 sec. at 80 amp. per sq. ft. at a temperature of about 170 deg. F. The bath composition is conventional. Between the alkaline and acid baths there is a scrubbing operation. The acid bath also is conventional in composition. The acid passage takes about 50 sec. at anywhere from 30 to 150 amp. per sq. ft. current density, the temperature being about 70 to 100 deg. F. The tin plating tanks are quite long, well over 200 ft. over all. Another procedure sometimes used to meet a customer's requirement is to provide an undercoating of nickel, copper, bronze or the like, with an acid tin overcoating.

From a mechanical standpoint, Crucible's tin line operates continuously and uninterruptedly. The strip to be coated feeds at constant speed, progressively through an electrolytic cleaning bath, scrubber, pickling tank, plating baths, scrubber, rinse tank and dryer, oil brightening equipment, oil degreasing tanks and dryer. The strip, initially in coil form, is fed from alternate pay-out blocks, through a welding unit and slack producer, of special design onto the plating line. The slack producer (see photo on page 40) permits of accumulating a reserve of the strip, to be paid out uniformly onto the line during an interval of welding coils end to end. At the end of the tin line, the strip passes through a "looper" of special design and thence onto alternate wind-up blocks for re-reeling.

For removing the oil film from the strip, resulting from its passage through the oil brightening equipment, a degreasing tank arrangement of special design (patent No. 2,234,593) is employed, which uses a chlorinated hydrocarbon solvent, through which the strip passes for liquid phase cleaning. The tank is divided into a series of compartments into which the clean and purified solvent enters at one end, and cascades through the remaining compartments in a direction opposite to the strip feed to provide a counter-flow cleaning action. In this way, the strip is fed progressively through cleaner solvent as the oil film is progressively removed, so that the cleaned strip finally passes out of the tank through the purified and cleaned solvent. The oiliest solvent at the strip entry is removed continuously to a vacuum still, where the solvent is distilled off and returned to the end opposite the strip entry. The oil residue remaining after distillation is removed from the still, and blown to a heating tank where it is heated and blown with air and then re-used as make-up oil supplied to the brightening tanks. Fresh oil is also added to these tanks, from time to time, to keep the viscosity low.

For successful operation, other mechanical features had to be worked out and embodied in the line, such as automatic guides for guiding the strip, special drive means for feeding the strip while automatically maintaining a relatively low tension thereon, plating tank contact roll assemblies of unique design for preventing plating out onto the rolls, etc.

There were two types of plating tanks installed initially, one with anodes and strip running horizontally, and the other with anodes and strip in a vertical position. The horizontal plating arrangement was found to have certain advantages and, in spite of its greater length, has been employed continuously since the first commercial operation. In this tank, the tin anodes above and below the strip are supported on lead covered stirrups, each side attached to a 7500 amp., 8-volt generator. Tin anodes are removed and replaced, generally after about 40 turns of operation, the scrap being melted and recast into new anodes. The strip is carried out of the solution over contact rolls which are connected to the negative side of the generator, the tin anode bus bars all being connected to the positive bus bars.

In the regular production of Crutin Lite, the cold-reduced strip is prepared for tin plating as follows: It is slit to the required width. It is then taken to the continuous normalizing furnace, a two-strand, vertical tower type furnace with a horizontal water-cooled table. The furnace and cooling table are supplied with a reducing, cracked gas atmosphere and heated with electric resistance units. The coils are mounted on either of two pay-out blocks furnished for each strand.

This furnace unit consists of the following items for each strand, in order from the pay-out blocks: a strip welder, slack producer, entry drive rolls, dancer stand, vertical furnace, cooling table, automatic guide, exit bridle or drive roll stand, dancer rolls, feed rolls, and double block wind-up. In operation, as the end of one coil approaches, the slack producer is run up carrying approximately 100 ft. of strip with it. When the end of the strip leaves the reel, the clamp is applied and holds stationary the end of the exhausted coil. The front end of the next coil is then spot welded to the end of the exhausted coil. While this operation is taking place, the strip in the slack producer is being fed at the regular rate through the furnace and the slack producer carriage is being pulled down. Operation at the wind-up end is quite similar in that slack is allowed to form in loops while the operator is cutting and attaching the new coil onto the empty reel. The strip is positively fed into the furnace by the entry rolls and drawn through by the bridle stand and wind-up at the exit end.

This furnace has proven that a single strand of steel exposed to the reducing gaseous atmosphere is cleaned while annealed, and that the oil remaining on the surface after rolling need not be removed in a cleaning line. However, cleaning is needed before pot annealing the steel for the electrolytic process as well as the hot dip.

The normalized or pot annealed product is temper passed on the pinch mills to the extent required by the use to which the tin plate is to be placed. It should be noted here that the product from the normalizing furnace shows a greater Rockwell hardness than can be obtained from the pot furnace. However, the normalized material does have excellent deep drawing qualities. The annealed and temper passed coils now go to the tin

line for the final operations already described.

The Midland plant was originally designed for 30 to 90 ft. line speed per min. This low speed has been increased to a maximum of approximately 200 ft. per min., which is about all the present equipment will stand without a complete re-building.

United Engineering Technique

As already mentioned, the United Engineering & Foundry Co., in cooperation with Hanson-Van Winkle-Munning Co., several years ago worked with a narrow pilot line at Weirton Steel Co. Now, two wide lines are being built, and from all information available this line will use a tin plating bath of the tin sulphate (acid) type. United is of the opinion that electroplated tin coating on wide strip (say, 32 in.) can be made very uniform in thickness, on the order of about 4 per cent. Coating uniformity is obtained by suitably maintaining anode widths less than the strip width, and by resorting to increasing the anode spacing near the edge as well as by the use of "current guards." Of particular interest is the United belief that anodes should be adjustable to prevent voltage increases as the anodes are used up, and the anodes might advisably be rotable, not only to permit uniform usage of same, but to further reduce polarization. Various considerations have influenced United to adopt a horizontal bath, the tank design being such that the strip is first plated on the underside, after which the strip reverses on itself on an upper level where the other side is plated as desired, after which the strip direction is again reversed through a rinse tank and dragout reclamation system. The plating tank is conceived as being on the order of 30 or 40 ft. in length, and current densities will run from 300 amp. to perhaps 500 amp. per sq. ft. Speeds of up to 500 ft. per min. for a coating weight of 0.5 lb. are considered feasible.

Prior to plating, the strip is passed through both an electrolytic cleaning treatment and a pickling treatment. The former treatment (about a 3-sec. dip in an electrolyzed cleaning solution) serves to remove accidental dirt or oil. The latter (5 to 10 sec. flash in conventional sulphuric acid bath) is to etch the surface to provide a better bond.

Mechanically, the United line may be broken into an uncoiling zone, a processing zone, and a recoiling or shearing zone. In the uncoiling zone, double uncoilers feed from dual coil feed lines for continuity. The succeeding operation involves two machine elements: a combination 4-high pinch roll stand and integral shear, and a combination double seam welder and integral shear. The 4-high pinch roll stand is arranged with the two intermediate rolls vertically operable together, so that only one or the other of the pinch roll units are in contact at one time. While the strip being processed is passing through the open rolls, the other unit is used to advance the front end of the strip of the coil being prepared, through the integral shear, where its front end is sheared square and true in readiness for joining. As the rear end of the strip being processed approaches the welder, the operator brings zone I equipment to a halt, permitting continuity of operation in the other two zones by the interposition of a looping device. The strip is then clamped in the welder, and the rear end sheared accurately and within 1/16 in. of the rear welding wheel face. The front end of the oncoming strip is then advanced to a stop fixed 1/16 in. ahead of the forward welding wheel, and the two strips clamped, while the double seam welder is run across the accurately fashioned lap at speeds approaching 50 ft. per min. The total overall "down time" to perform this joining operation takes from 15 to 30 seconds, depending on the strip width, gage, etc.

Next, a rubber covered pinch roll unit serves to uncoil the strip off the active uncoiler, and to maintain the proper amount of strip in the succeeding looper, for continuity of operation. By providing a 40-ft. deep looping pit, in which 80 ft. of strip hangs freely without danger of scratching, it is necessary to slow the line down only to 160 ft. per min. during the joining operation.

Zone II equipment covering essentially all processing equipment is operated so that it preferably never stops. This involves plating baths already mentioned, with the addition of a drag tension machine, a master pull tension unit, and one or more automatic guiding units. The pull and drag units are really inverted machines, in which the strip wraps around at least two rubber covered rolls either mechanically or electrically connected together to act as "flying winches." These units, one at the delivery end of the zone, and the other at the entry end, serve to positively keep the strip moving at a controlled speed and tension.

The second zone ends at the master tension pull unit, after which a slight operation loop is maintained for purposes of strip guiding so that accurate, straight sided coils may be produced. Following this loop, zone III begins with a drag tension unit, against which the coils are reeled. This is followed by the branner, placed at this somewhat delayed point to prevent oil from the branner getting on the tension unit rolls and interfering with their proper operation.

The continuous recoiling equipment consists of a combination up-and-down pneumatic snip shear and deflectors, two collapsible reels and individual belt wrappers, dual reel strippers and coil receivers, all automatically operable from a magnetic pickup that recognizes the approach of the end of the coil.

Desulphurizing at the Blast Furnace

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. . . Speeding up iron production without constructing new blast furnaces may be aided by careful control over metal analyses. Here, the author of "Rapid Metallurgy in War Production," THE IRON AGE, April 23, describes methods of desulphurizing pig iron in the ladle and at the casting machine.

WITH the proper equipment, desulphurizing molten pig iron is just as simple and just as practical as desulphurizing in the hundreds of iron foundries now treating the iron from cupolas; the only difference being one of volume. Desulphurizing at blast furnaces not only offers the means of increasing production of pig iron and steel at this time of emergency, but will prove highly profitable at many furnaces as it has at foundries.

Desulphurizing at foundries was started as a means of using high percentages of scrap in the cupola charge and to offset oxidation and high sulphur pick-up in the cupola coming with the use of the generally inferior foundry coke supplied to foundries following the first World War. Today, however, the refining that comes with desulphurizing in foundry operations is considered of far more value than the actual removal of sulphur; and it is reasonable to expect that the same will apply to desulphurizing iron once this is established as a regular practice. Furthermore, once a soundly engineered system of desulphurizing is in operation, it will not require any extra effort or added supervision on the part of blast furnace operators, but will run along of its own accord.

Desulphurizing at blast furnaces to the extent of 50 to 60 per cent of the contained sulphur may be accomplished by any one of several practical systems. Probably the method most generally adaptable to existing furnaces where open type transfer ladles are used would provide for continuous feed of the reagent on the stream of iron as it flows from the furnace into the ladle and skimming off the spent slag ahead of the mixer or open hearth. With submarine or mixer type ladles, it would be necessary to provide for a repouring station or desulphurize between the mixer and open hearth.

Some added loss of temperature would result with repouring and the sulphur reduction would be somewhat lower than obtained by treatment at the furnace. In each of the foregoing methods it is necessary to skim-off the spent soda slag, which is a nasty operation. However, with a little attention to working out a practical system, this operation can usually be simplified and would cease to be a nuisance.

At new blast furnaces, or at existing stacks where the hearth and head room will permit the installation, the arrangement shown in Fig. 1 will prove efficient and practical, and once in operation offers the advantage of a minimum of disturbance with regular blast furnace-open hearth routine. The equipment consists of two 30 to 40 ton capacity teapot ladles set in the furnace platform. A hood with exhaust system would be arranged to move over and away from the ladle for carrying off the dust and fumes at furnaces with closed-in hearths. The iron runners are arranged so that the stream of iron from the furnace can be by-passed through either one of the two desulphurizing reservoir ladles and back into the runner leading to the transfer ladle; or the cast can be made direct into the transfer ladle without desulphurizing.

During the cast, the ladle is maintained in an upright or a slightly tilted position, with the reagent being fed on the stream of iron in the runner leading to the ladle. Complete separation of the iron and soda slag is effected by the teapot spout; thus delivering slag-free iron to the transfer

ladles. At the end of the cast the teapot ladle is lowered and most of the spent slag flowed off at the back, after which the last iron is poured off and the ladle lowered into position ready for the next cast. This arrangement is an enlargement of the system now followed in hundreds of foundries and when properly engineered should prove equally practical and efficient at blast furnaces.

Where the metal is cast into pigs, desulphurizing can be done at the pig casting machine. Fig. 2 illustrates a desulphurizing unit adapted to a two-strand machine. This consists of a teapot pouring reservoir of a capacity to hold the iron in contact with the soda slag from three to five min. The reagent is continually fed onto the stream of iron from the ladle during the pour or added to the reservoir at a point where it will be whipped into the bath by the stream. The bath of slag is allowed to build up to a depth of from one to several in. in thickness, as found by trial, to give the most efficient results, and is maintained at the proper level by regulating the height of the slag-off spout.

Desulphurizing Reagents

The alkalies available for commercial desulphurizing practice include, in the order of their activity:

(1) Soda Ash (Na_2CO_3)
(2) Soda Ash—Caustic Mixtures
(3) Caustic Soda—(NaOH)

The active reagent in each is sodium oxide (Na_2O), of which soda ash contains 58 per cent and caustic soda 76 per cent. Thus caustic soda with 76 per cent Na_2O is proportionately more active than soda ash with 58 per cent Na_2O. Under favorable conditions, upwards of 85 per cent of the sulphur present in cupola iron, within the range of from 0.06 to 0.13 per cent sulphur, can be removed with caustic soda in one treatment without external heat. The maximum reduction obtainable when treating similar irons with soda ash is about 75 per cent. The limits of percentage reduction is somewhat lower with pig iron, probably in the order of 65 to 75 per cent maximum reduction. This difference is due to the impracticability of attaining ideal conditions for maximum efficiency in practical operations at most blast furnaces.

Caustic soda, commonly known as household lye, will absorb moisture from the air, and must be shipped in air-tight containers, usually steel drums. As the name implies, it is highly caustic and must be handled with gloves. Wherever used, it is the general practice to charge the entire drum into the ladle of iron at one time, after first perforating in one or two places to prevent an explosion. Caustic soda, because of its high concentration, lower melting point, and greater activity, as compared to soda ash, makes for more violent boiling action or more rapid contact between the metal and slag. These factors account for the high per cent sulphur reduction obtained with this reagent. Boiling of caustic slags may be prolonged in some cases by additions of soda ash and other carbonates with the caustic. With fused soda ash used with caustic or alone, boiling action is prolonged by gradually melting the two-lb. briquets which continually provide a fresh supply of free alkali that is whipped under the bath; thus effecting some increased efficiency.

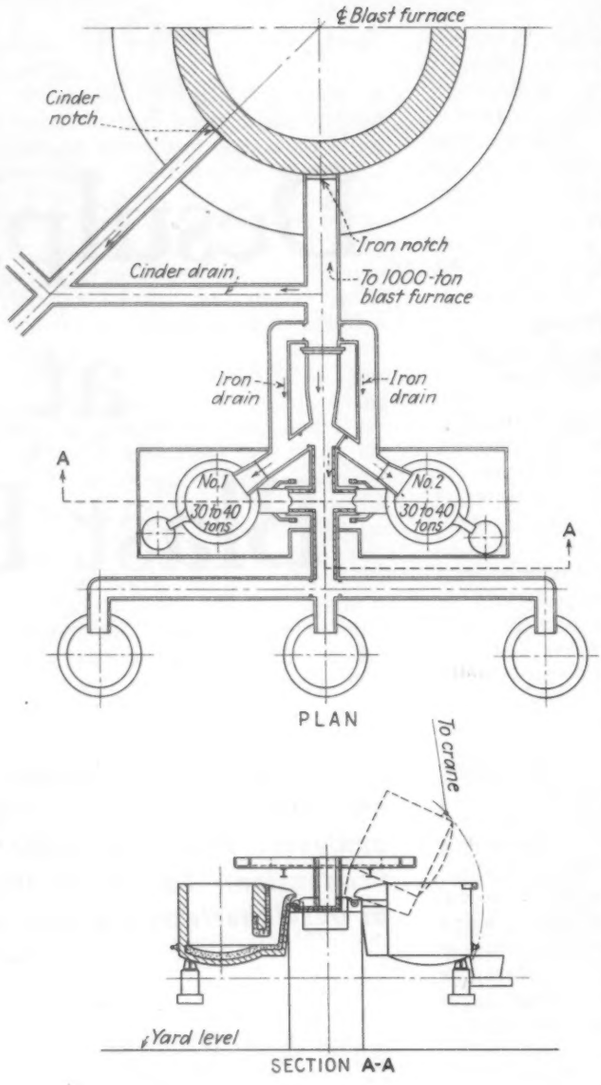

FIG. 1—Plan for a two 30 or 40 ton teapot ladle desulphurizing unit at the blast furnace platform.

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Soda ash is available as (1) 58 per cent light ash, a fine precipitated product which is too dusty for use in desulphurizing; (2) 58 per cent dense ash, also too light and dusty for practical desulphurizing operations; (3) granular soda ash, carrying 10 to 30 per cent dusty grade; (4) crystalline granular ash,* containing 56 per cent Na_2O, is practically free from dustiness; (5) soda ash briquets, containing 52 per cent Na_2O, is also dustless, but carries some fines; and (6) fused soda ash,* containing plus 58 per cent Na_2O with traces of caustic. Fused soda ash is available in 2-oz. tablets, ½-lb. cakes and 2-lb. pigs. It is not only dustless, but produces less fumes and is more efficient than other forms of soda ash.

Sulphur Reductions

By knowing the approximate sulphur content of the iron coming from the blast furnace, and varying the desulphurizing treatment accordingly, it is thoroughly practical with iron of 0.09 per cent sulphur, to reduce the sulphur to 0.035 per cent by ladle treatment with soda ash. This applies alike to high or low manganese irons.

Crystalline granular ash is sold under the trade name Granular Purite, and fused soda ash as Purite.

Under ordinary blast furnace practice, with proper separation of the furnace slag by the dam, and assuming a reasonably clean ladle, 10 lb. of granular soda ash per ton of iron properly fed on the stream during the cast will normally effect sulphur reductions in the order of:

Sulphur Content of Iron in Cast, Per Cent	Reduction in Sulphur by Treatment, Per Cent	Sulphur Content of Iron After Treatment, Per Cent
0.03	30	0.021
0.04	40	0.024
0.05 to 0.06	50	0.030
0.09	55	0.041

This represents the minimum per cent reductions that can be expected at blast furnaces almost anywhere. Increased reductions will be obtained with the use of larger additions of soda ash per ton; however, the per cent sulphur reduction per unit of reagent will fall off rapidly as the amount of reagent added is increased above 10 or 12 lb. per ton of iron.

Causes for the erratic or unsatisfactory results with desulphurizing sometimes reported by both blast furnace and foundry operators have usually been the result of their failure to take into account the fundamentals involved in desulphurizing with the alkalies. For instance, at cupolas or blast furnaces variations in the quantity of slag coming out with the metal, and at blast furnaces differences in the amount of entrained silicates and/or kish in the different casts, will materially affect results. Furthermore, the alkalies instantly unite with any free slags, dirt in the ladle, or silicates in the iron in preference to reactions with sulphur. These along with any kish coming off, both dilute the reagent and reduce the slag-metal surface contact, thereby retarding the desulphurizing reactions.

Metal-Soda Slag Contact

The most important factor in efficient desulphurizing, with the exception of the iron temperature, is rapid and intimate contact between the metal and soda slag. The stream of iron flowing into the desulphurizing ladle promotes slag metal contact, both by the physical effect of the stream in stirring the metal and by its action in whipping portions of the freshly melted or undecomposed alkali down into the metal bath. This not only increases the extent of slag metal surface contact, but makes for more effective contact because of the pressure of the overlying metal. Moreover, decomposition of the reagent under the metal surface with the consequent evolution of gases, causes a boiling action that acts to further increase surface contact.

To insure clean iron, the runner immediately in front of the furnace should be made extra large and the skimmer should extend well below the surface of the iron in the runner so as to separate the slag and iron completely. To insure maximum surface contact between the soda slag and metal, the reagent, preferably dustless granular soda ash, should be added on the stream of iron as it flows into the ladle. The rate of additions should be relatively higher at the beginning of the cast in order to provide a good volume of slag in the ladle at the start. The rate of feed of the soda ash is reduced thereafter to finish adding the predetermined quantity near the end of the cast.

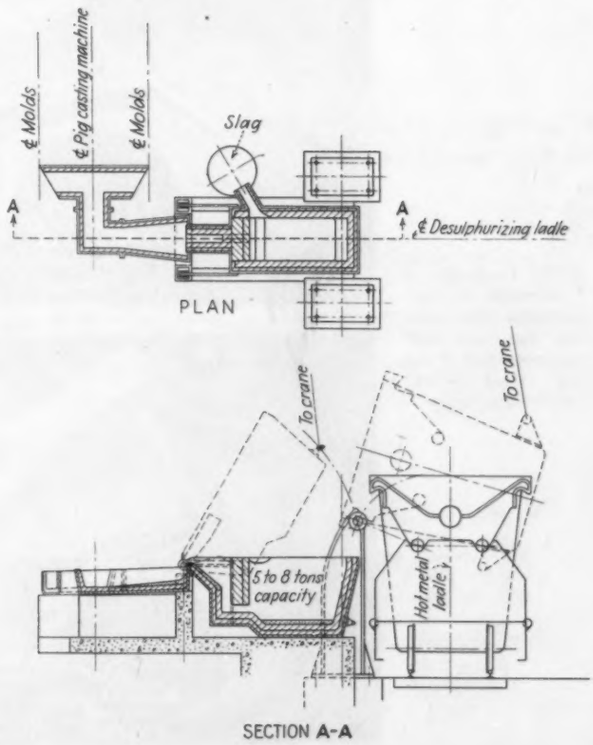


FIG. 2—A desulphurizing unit adopted to a two-strand pig casting machine.

Ladle Linings

Soda slags are particularly reactive to ordinary clays or plastic cements used in laying up ladle brick, and tend to eat out the joints and loosen the brick. Most of the reports on excessive ladle lining costs with desulphurizing can be traced to the use of inproper brick and to laying up the ladle lining with thick mud joints. First of all it is essential to provide a double thickness lining in desulphurizing ladles. For best results, the brick should be of a siliceous type, hard burned and true to form, and should be laid up with tight joints either dry or with a milk thin grout of high-grade fire clay. Such a lining expands on being heated up and seals the joints, making an almost monolithic lining that resists the action of alkali slags most efficiently. With the right type of brick and laying up the lining as described, and when desulphurizing to the extent of 40 to 50 per cent of the sulphur contents of the iron as it comes from the furnace, total ladle lining maintenance costs including labor and material will not exceed 4 to 6c. per ton of molten iron treated.

Desulphurization Is Profitable

Desulphurizing at blast furnaces is entirely practical; and it offers the means of quickly and materially increasing production of pig iron. Finally, desulphurizing will most certainly prove profitable at many locations once the system is installed as regular blast furnace-open hearth routine practice, and full use is made of the lower silicon and lower sulphur irons obtainable in this way. In view of the urgent need for steel and more steel to speed our war production, this simple means of substantially increasing iron and steel production should not be overlooked.

Faster Arc Welding With Less Electrode Material

LOWER costs and speed increases up to 100 per cent, with an actual reduction in electrode material per foot of weld, are among the advantages claimed for "Fleet-Fillet," a new arc welding technique.

Four factors govern procedure in the new technique: (1) A change from the conventional electrode position; (2) the use of higher currents than those now commonly employed; (3) movement of the arc at a higher speed; and (4) the use of shielded-arc electrodes of the type recommended for the technique.

The newly developed process is based on securing greater penetration at the root of a fillet weld. Penetration into the root of a weld increases with increase in the speed of travel and with increased current to the extent shown in the table. It is from the effect of speed of travel on penetration that the process derives its name. Details of the method, originally announced a few weeks ago (THE IRON AGE, April 2, p. 129), have just been made public by its developers, the Lincoln Electric Co. It is said to strike an economically practical average between the ideal fillet and the conventional fillet.

Electrode Position

Fig. 1 is a comparison of conventional electrode position with that recommended in the "Fleet-Fillet" technique. Ordinarily, the electrode is held at approximately 45 deg. with the horizontal plate and at 60 deg. with the line of weld, with the end pointing backward. The arc is held short but the travel speed is generally so slow that the electrode must be held out from the two plates in order to keep the end of the electrode from dipping into the molten pool.

The average position of the electrode in the new process is from 45 to 60 deg. with the horizontal plate in a plane about perpendicular to the line of weld. The arc is so short that the coating practically touches the plate. Lightly resting the coating against both plates is not objectionable, but if the coating is forced against the plates a rough bead is likely to result.

Three practical examples are shown in Fig. 2. Note the increased

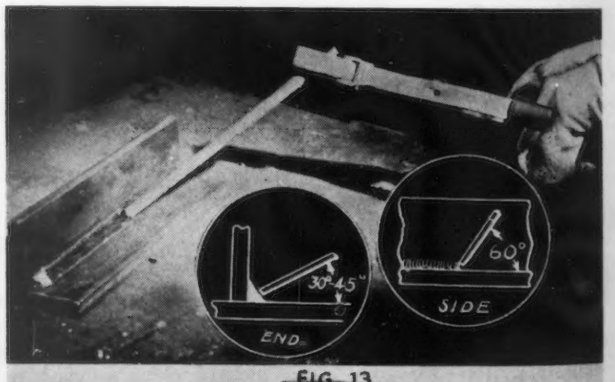
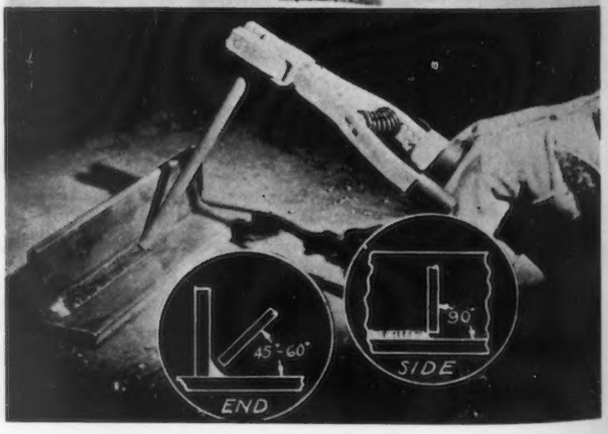


FIG. 1—Angle of electrode for conventional fillet welding, top, and that recommended for the "Fleet-Fillet" technique, below.

FIG. 13



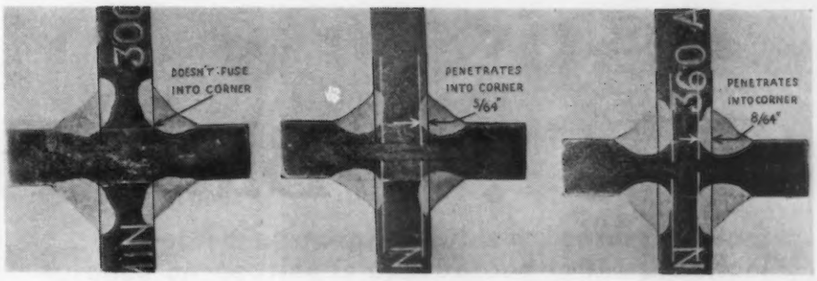
penetration of the fillet into the root of the weld in the center illustration, *B*, secured with the same electrode and the same current—merely by changing the electrode position and the speed of application. Data in the table indicate the same ultimate strength for this weld as for the conventional joint *A* shown to the left. By increasing the speed still more and stepping up the current by 20 per cent, a stronger joint, *C*, can be produced. It will be noted from the table that the ultimate strength of this joint was not determined, since the plate failed before the weld.

Multiple-Pass Fillets

The conventional method of building up a multiple-pass horizontal fillet is shown at the left in Fig. 3. Here the beads are laid from the top downward. The center illustration shows the "Fleet-Fillet" method of laying the beads from the bottom upward. The idea here is to provide a flat horizontal surface upon which to place succeeding beads, permitting higher currents and faster welding. The first bead is laid in the corner at a fairly high current and speed. Subsequent beads are put on with the electrode held at an angle of 70 to 80 deg. with the horizontal plate and line of weld, except that the beads against the vertical plate are laid down with the electrode held at a 45 deg. angle.

It is interesting to note that the slag is left on the lower bead in order to provide a dam to keep the metal from running off the edge of the previous bead. This is shown in the right-hand illustration of Fig. 3. The slag is not removed until after each layer of beads is completed. In other words, for the weld shown at the right in Fig. 3, the slag is removed after completion of bead No. 1 and bead No. 4. This procedure not only saves man-hours in cleaning the weld, but makes possible a cleaner weld. Any number of layers of beads may be built up in this manner.

The "Fleet-Fillet" technique is expected by its developers to speed up horizontal and positioned fillet welding considerably. It can be applied to single or multiple-pass welds of this type, and points the way to a considerable saving in electrode material. Furthermore, the cost of fillet welding by the "Fleet-Fillet" technique is reported 33 1/3 to 50 per cent less than by usual procedure. Penetration of the weld beyond the root or corner of the joint is also reported considerably better and the size of the weld is noticeably smaller, yet strength is equal. Amount of electrode per foot of joint is also materially less with the Fleet-Fillet technique. In a typical instance, the new technique required 0.26 lb. per foot, as against 0.37 lb. by usual procedure.



A B C

FIG. 2—Three cross-sectioned fillet welds in 1/2-in. plates illustrating the new technique. The plates at the left were welded by conventional methods with 300 amp. at a speed of 7 in. per min. The center view shows the effect of increasing the arc speed to 10 in. per min., using the same current. By stepping up the current to 360 amp. and using an arc speed of 12 in. per min., the welds shown at the right were obtained. All were welded in a horizontal position, with direct current and the electrode negative.

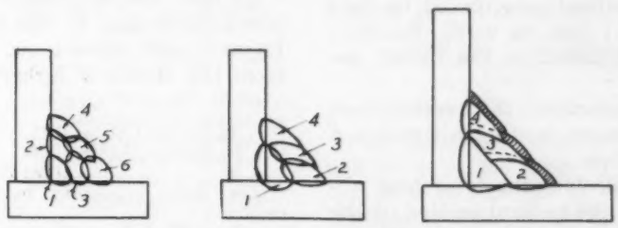


FIG. 3—Sequence of passes with conventional fillet welding method, left. The drawing in the center shows the sequence with "Fleet-Fillet" technique. In the right-hand illustration, the dotted line above No. 2 bead shows where slag was before bead No. 3 was put on. The dotted line above No. 3 indicates the location of slag before bead No. 4 was put on. The cross-hatched area shows slag after completion of the weld.

Comparison Tests for Single-Pass Horizontal Fillets (Not Positioned), Made by Conventional and Fleet-Fillet Techniques

Cross-sections of Welds, Fig. 2	A, Conventional Method	B, "Fleet-Fillet" Method	C, "Fleet-Fillet" Method
Electrode	1/4 in. Fleetweld 9	1/4 in. Fleetweld 9	1/4 in. Fleetweld 9
Current, Amp. d.c. electrode negative	300	300	360
Arc speed—in. per min.	7	10	12
Size of fillet, in.	24/64	17/64	18/64
Apparent throat 0.707 x size of fillet, in.	17/64	12/64	13/64
True or effective throat, in.	17/64	17/64	20/64
Penetration beyond root or corner, in.	0	5/64	8/64
Ultimate load of joint in lb. per in. of length	27,000	27,000	30,000 (Plate failed)
Costs			
Weight of electrode per foot of weld, lb.	0.37	0.26	0.26
Electrode cost per foot of weld, cents*	2.2	1.5	1.5
Labor cost per foot of weld, cents†	5.8	4.0	3.3
Overhead—100 per cent of labor cost, cents	5.8	4.0	3.3
Total cost—Labor, electrode and overhead, cents	13.8	9.5	8.1

* Electrode cost figured at 6c. per lb.
† Labor cost figured at $1 per hour with a 50 per cent operating factor.

. . . Blast Furnace Air H

TO more clearly illustrate the adaptation of tubular heaters for heating blast furnace air, a hypothetical case, based on data in Table I, will be used. The procedure followed in the heater design is:

(1) Determine the radiant heat transfer rates for the roof, wall and shield tubes.

(2) Calculate the total heat absorbed in the radiant section of the heater which must balance with the heat extracted from the products of combustion up to the point where the gases enter the convection section.

(3) Calculate the heat absorbed in the convection section which must balance with the heat extracted from the products of combustion between the points where the gases enter the convection section and the flues enter the waste heat boiler.

(4) Check the assumed tube wall temperatures in the preceding calculations.

(5) Calculate the pressure drop of the air through the tubes.

(6) Calculate the draft loss for the flue gases.

The calculation of the radiant heat transfer rates is dependent upon the mean radiating beam length of the combustion products which is a function of the shape of the furnace. The combustion chamber in this case has the following dimensions: Width, 17.5 ft.; height, 17.5 ft.; length, 36.5 ft. The ratio of these dimensions is 1 : 1 : 2.08 and Hottel's recommendation for the value of L is:

$$L = 0.66 \sqrt[3]{\text{Furnace Volume}}$$

$$L = 0.66\sqrt[3]{11178} = 14.76 \text{ ft.}$$

The products of the beam length and the partial pressures of the radiating gases are:

For the CO_2 in the flue gasses:
$P_cL = 0.1925 \times 14.76 = 2.84$
For the H_2O in the flue gases;
$P_wL = 0.1420 \times 14.76 = 2.10$
$P_cL + P_wL = 4.94$
Ratio $CO_2 : CO_2 + H_2O = 0.576$

At the reduced furnace temperature of 1800 deg. F., the emissivity factors and corrections obtained from the Hottel & Egbert[46] curves are:

E_c for the CO_2 = 0.21
E_w for the H_2O = 0.37
K = 9 per cent

The flame emissivity may now be obtained.

$P_f = E_c + E_w - K$
$P_f = 0.21 + 0.37 - 0.09 = 0.49$
$A_t = (2 \times 17.5 \times 17.5) + (4 \times 17.5 \times 36.5) =$ 3167 sq. ft.
α, for single rows, roof and wall tubes = 0.935
α, for double rows, shield tubes = 0.992
αA_{cp}, roof walls = $0.935 \times 40 \times {}^{10}/_{12} \times 36.5 =$ 1137 sq. ft.
αA_{cp}, shield tubes = $0.992 \times 20 \times {}^{10}/_{12} \times 36.5 =$ 603 sq. ft.
Total, αA_{cp} = 1740 sq. ft.

Therefore,
$A_r = A_t - \alpha A_{cp} = 3167 - 1740 =$ 1427 sq. ft.

Therefore,
The ratio, $A_r : \alpha Acp = 1427 : 1740 =$ 0.82
$F_{re} = \alpha A_{cp} : A_t = 1740 : 3167 = 0.55$

F_s, the angle emissivity factor, may now be calculated from formula (3):

$$F_s = P_f\left[1+\left(\frac{A_r}{\alpha A_{cp}}\right)\frac{1}{1+\left(\frac{P_f}{1-P_f}\right)\frac{1}{F_{re}}}\right] \quad (3)$$

$$F_s = 0.49\left[1+0.82\,\frac{1}{1+\left(\frac{0.49}{1-0.49}\times\frac{1}{0.55}\right)}\right]$$

$F_s = 0.49\,[1 + (0.82 \times 3.64)]$
$F_s = 0.636$

The overall exchange factor (ϕ) may be calculated from formula (2). It will be necessary to determine one value of ϕ for the wall and roof tubes and another for the shield tubes on the assumption that 18-8 chrome-nickel tubes will be used for the roof and wall tubes and 25-20 chrome-nickel tubes in the shield. Thus the values of p_c appearing in the formula will be:

p_c for 18-8 tubes = 0.73 (McAdams[23])
p_c for 25-20 tubes = 0.98 (McAdams[23])

The value of ϕ is given by formula (2):

$$\phi = \frac{1}{\frac{1}{F_s}+\frac{1}{P_c}-1} \quad (2$$

For the roof and wall tubes:

$$\phi = \frac{1}{\frac{1}{0.636}+\frac{1}{0.73}-1}$$

$$\phi = \frac{1}{1.57 + 1.37 - 1} = \frac{1}{1.94} = 0.515$$

For the shield tubes:

$$\phi = \frac{1}{\frac{1}{0.636}+\frac{1}{0.98}-1}$$

$$\phi = \frac{1}{1.57 + 1.02 - 1} = \frac{1}{1.59} = 0.629$$

The heat absorption and the overall radiant heat transfer rates may now be calculated from formula (1):

$$q = 0.173\,(\alpha A_{cp})\,\phi\left[\left(\frac{T_g}{100}\right)^4 - \left(\frac{T_s}{100}\right)^4\right] + h_c A_c\,(T_g - T_s) \quad (1)$$

For the roof and wall tubes

T_g = 1800 deg. F. + 460 deg. F. = 2260 deg. R
T_s = 1100 deg. F. + 460 deg. F. = 1560 deg. R
$(T_g \div 100)^4 = 260{,}870$
$(T_s \div 100)^4 = 59{,}230$
$(T_g \div 100)^4 - (T_s \div 100)^4 = 201{,}640$

Assuming a convection coefficient of 2.5 for h_c the heat absorbed by the roof and wall tubes will be equal to:

$q = (0.173 \times 1137 \times 0.515 \times 201{,}640) + (2.5 \times 2300 \times 700)$

$q = 20{,}426{,}000 + 4{,}025{,}000$
$= 24{,}451{,}000$ B.t.u. per hr.

For the shield tubes
T_g = 1800 deg. F. + 460 deg. F. = 2260 deg. R
T_s = 1500 deg. F. + 460 deg. F. = 1960 deg. R
$(T_g \div 100)^4 = 260{,}870$
$(T_s \div 100)^4 = 147{,}600$
$(T_g \div 100)^4 - (T_s \div 100)^4 = 113{,}270$

Assuming a convection coefficient of 6.75 for h_c the heat absorbed by the shield tubes will be equal to:

$q = (0.173 \times 603 \times 0.629 \times 113{,}270) + (6.75 \times 2300 \times 300)$

Heating

By GUSTAVUS AUER
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o o o

. . . A problem of adapting tubular heaters to blast furnace air heating is approached in the practical manner of taking an illustrative example and developing it completely, in this last of this series of three articles.

$$q = 7{,}433{,}000 + 4{,}658{,}000 = 12{,}091{,}000 \text{ B.t.u. per hr.}$$

The total heat absorbed in the radiant section is equal to:

$$q = 24{,}451{,}000 + 12{,}091{,}000 = 36{,}542{,}000 \text{ B.t.u. per hr.}$$

Total heat release in combustion chamber	235,000,000 B.t.u. per hr.
Allow 2 per cent radiation loss in combustion chamber	4,700,000 B.t.u. per hr.
Net heat available in combustion chamber	230,300,000 B.t.u. per hr.
Deduct heat absorbed in combustion chamber	36,542,000 B.t.u. per hr.
Net heat in flue gases in leaving combustion chamber	193,758,000 B.t.u. per hr.

Heat in flue gases = 193,758,000 ÷ 2,526,000 = 76.71 B.t.u. per standard cu. ft. of fuel.

This value corresponds to a temperature of 1800 deg. F., as shown on Fig. 1, by the 2100 deg. F. reduced temperature curve and checks the assumed mean combustion temperature. This is also the temperature of the gases entering the first convection tube bank as the convection transfer to the shield tubes has been extracted. The values allowed for the convection coefficients on the radiant section tubes may be checked, but the procedure is similar to the following convection section calculations and it will not be detailed separately.

It will be necessary before approaching the design of the convection section of the heater to observe the actual temperature conditions of the air being heated in the radiant tubes based on the heat absorption just calculated.

The temperature rise in the air passing through the roof and wall tubes, using a mean specific heat of 0.237 for the air will be:

Temperature rise = 24,451,000 ÷ (366,720 × 0.237) = 281.3 deg. F.

The temperature entering the convection tubes at the flue gas outlet is therefore 100 + 281.3 or 381.3 deg. F.

The temperature rise in the air passing through the shield tubes, using a mean specific heat of 0.247 for the air will be:

Temperature rise = 12,091,000 ÷ 366,720 x 0.247 = 133.5 deg. F.

The temperature leaving the convection section is therefore 1400—133.5, or 1266.5 deg. F.

It is now possible to calculate the performance of the convection section. The area of heating surface required in a tube bank consisting of tubes spaced in a staggered relation with the air to be heated passing through the tubes and the flue gases passing over the external surfaces is equal to the sum of the heat transferred by convection and the heat absorbed by direct radiation from the hot gases. An additional amount of heat will be reradiated from the refractory walls surrounding the tubes. It is convenient to calculate the heat absorbed by forced convection and that absorbed by radiation, direct and reradiated, separately. The two quantities may be added to give the total convection section heat absorption.

The heat transfer coefficient for the gases at the external surface of the tubes is given by the Monrad[18] equation:

$$h_c = \frac{1.75\, T^{0.3}\, G^{0.66}}{D^{0.33}} \qquad (5)$$

h_c = convection coefficient of heat transfer in B.t.u. per sq. ft. per hr. per deg. F.
T = mean temperature of the flue gases in deg. Rankine.
G = mass velocity of the flue gases at the minimum cross sectional area between the tubes, lb. per sq. ft. per sec.
D = outside diameter of the tubes, in.

The temperature in this case may be taken as the arithmetical average of the flue gases entering and leaving the tube bank.

$$T = \frac{1800 \text{ deg. F.} + 1100 \text{ deg. F.}}{2} + 460 \text{ deg. F.} = 1910 \text{ deg. Rankine}$$

The tubes in the convection bank will be 6 in. o.d. and 5½ in. i.d., spaced 9 in., center to center, on equilateral triangular pitch. The exposed surface of each tube will be 36.5 ft. long. It will be assumed that there will be 20 tubes in each row at right angles to the direction of flow of the flue gases. The free area between the tubes will be taken as 20 times the clearance between the tubes. This will take into account the clearance between the end tubes and the refractory wall surfaces on each side of the convection section. The mass velocity of the gases passing over the tubes will be:

$$G = \frac{\text{lb. of gas per hr.} \times 12 \text{ in.}}{3600 \times 20 \times 3 \text{ in.} \times 36.5 \text{ ft.}}$$

$$G = \frac{400{,}500 \times 12}{3600 \times 20 \times 3 \times 36.5} = 0.609 \text{ lb. per sq. ft. per sec.}$$

Substituting the proper values in equation (5):

$$h_c = \frac{1.75 \times 1910^{0.3} \times 0.609^{0.66}}{6^{0.33}}$$

$$h_c = \frac{1.75 \times 9.645 \times 0.7208}{1.8} = 6.736$$

The average rate of heat transfer in the convection section is given by the formula:

$q' = h_c \times \Delta T_M$, in which:
q' = B.t.u. per sq. ft. per hr.
h_c = as previously stated.
ΔT_M = logarithmic temperature difference between the mean flue gas temperature and the mean tube wall temperature.

The mean tube wall temperatures are usually assumed from a knowledge of the temperature of the gases on the external surfaces and the temperature of the air passing through the tubes with consideration for the thermal resistances and

conductivity of the tube wall and tube wall surfaces. The following temperatures will therefore be used in the calculation of the temperature difference.

Inlet gas temperature, $t_{g1} = 1800$ deg. F.
Outlet gas temperature, $t_{g2} = 1100$ deg. F.
Tube wall temperature air inlet, $t_{s1} = 700$ deg. F.
Tube wall temperature air outlet, $t_{s2} = 1500$ deg. F.

Under the above temperature conditions, the arithmetical temperature difference is sufficiently accurate and $\triangle T_M$ may be determined as follows:

$$\Delta T_M = \frac{(t_{g1} - t_{s2}) + (t_{g2} - t_{s1})}{2}$$

Substituting the temperatures in this formula:

$$\Delta T_M = \frac{(1800 - 1500) + (1100 - 700)}{2}$$

$$\Delta T_M = 350 \text{ deg. F.}$$

The convection heat transfer rate (q′) will then become:

$q' = 6.736 \times 350 = 2357$ B.t.u. per sq. ft. per hr.

The radiant heat absorbed in the convection section which may be added to the convection heat transfer rate may now be calculated. The tubes are to be spaced on an equilateral triangular pitch and the wall height associated with each row of tubes will be equal to:

$(9/12)\ (0.5\ \sqrt{3}\ )$ or 0.649 ft.

The wall area associated with each row of tubes is equal to:

$[(9/12)\ (20)\ (2) + (36.5)\ (2)]\ 0.649 = 66.85$ sq. ft.

Each row of tubes has an area of $\pi\ (6/12)\ (36.5)\ (20)$, or 1146 sq. ft. An effectiveness factor for the wall radiation of 0.7 is recommended, and the equivalent tube area for the absorption of radiant heat will be expressed as follows:

$$\frac{1146 + (0.7 \times 66.85)}{1146} = 1.04 \text{ sq. ft. per sq. ft. of actual area.}$$

The radiant heat transfer may be calculated by the use of Figs. 4, 5 and 6, and substitution of the proper values in the equation as given by McAdams:

$$\frac{q''}{A_c} = A_s\, p_s\, [(C_g + W_g - K_g) - (C_s + W_s - K_s)] \qquad (7)$$

in which:

q'' = the heat transfer per sq. ft. of circumferential tube area in B.t.u. per sq. ft. per hr.
A_c = the actual circumferential tube area, in sq. ft.
A_s = the equivalent surface per sq. ft. of actual tube area.
p_s = emissivity of the tubular surface.
C_g = radiation due to carbon dioxide, B.t.u. per sq. ft. per hr. at the mean gas temperature.
W_g = radiation due to water vapor, B.t.u. per sq. ft. per hr. at the mean gas temperature.
K_g = correction for superimposed radiation due to the presence of CO_2 and H_2O. Per cent correction $\times$ $(C_g + W_g)$ B.t.u. per sq. ft. per hr.
C_s = radiation due to carbon dioxide, B.t.u. per sq. ft. per hr. at the mean tube wall temperature.
W_s = radiation due to water vapor, B.t.u. per sq. ft. per hr. at the mean tube wall temperature.
K_s = correction for superimposed radiation due to the presence of CO_2 and H_2O. Per cent correction $\times$ $(C_s + W_s)$ B.t.u. per sq. ft. per hr.

The values of C_g, W_g, K_g, C_s, W_s, K_s, may be read from Figs. 4, 5, and 6 after calculating P_cL and P_wL for the convection section. For the staggered tube arrangement, Hottel recommends that L be taken as 2.8 times the clearance between the tubes, or $L = 2.8 \times 3/12 = 0.7$ ft. P_c and P_w are the same values used in the radiant section calculations, namely, $P_c = 0.1925$ and $P_w = 0.142$. Then $P_cL = 0.1925 \times 0.7$ or 0.1347, and $P_wL = 0.142 \times 0.7$ or 0.0994. The value of CO_2: $(CO_2 + H_2O)$ is the same as before, 0.576, and $P_cL + P_wL = 0.234$.

It is now possible to select the proper values for substitution in equation (6) from the charts Figs. 4, 5, and 6. The value of P_s will be approximately 0.70 on the assumption that calorized carbon-molybdenum tubes or chrome-nickel tubes will be used.

The mean radiating gas temperature for the selection of values from the charts should be equal to the sum of the average tube wall temperature and the logarithmic or arithmetical mean temperature difference between the products of combustion and the tube walls. The latter will be 350 deg. F., because previously calculated for forced convection and the mean tube wall temperature is $(1500 + 700) \div 2$ or 1100 deg. F. The mean radiating temperature is therefore 1100 + 350 deg. F., or 1450 deg. F. The values of K are read from Fig. 6 as per cent of (C + W) and multiplied by this sum for insertion in the equation.

The substitutions in equation (7) follow:

$$\frac{q''}{A_c} = 1.04 \times 0.7\ [(C_{1450} + W_{1450} - K_{1450}) - (C_{1100} + W_{1100} - K_{1100})]$$

$$\frac{q''}{A_c} = 1.04 \times 0.7\ [(1950 + 1250 - 118) - (880 + 690 - 58)]$$

$$\frac{q}{A_c} = 0.728\ (3082 - 1512)$$

$$= 0.728 \times 1570 = 1143 \text{ B.t.u. per sq. ft.}$$

The total heat transfer rate in the convection section will then be equal to the sum of that transferred by convection and that by radiation or 2357 + 1143, or 3500 B.t.u. per sq. ft. per hr.

The duty of the convection section is obtained as follows:

Total heat absorbed by air in the heater, 116,324,000 B.t.u. per hr.

Heat absorbed in radiant section, 36,542,000 B.t.u. per hr.

Net convection section duty, 79,782,000 B.t.u. per hr.

The total heating surface required is: 79,782,000 ÷ 3500, or 22,800 sq. ft.

The number of tubes to be used will be 400, or 20 rows with 20 tubes to a row, and the actual surface area will be 22,920 sq. ft.

Operating Condition Factor

The design of the convection section should be based on the plant operating conditions at which the installation is to be made. A substantial saving in the costs of the furnace can be made if the tubes are spaced closer than 9 in., center to center. This spacing was selected as representative of average practice where good heat transfer can be obtained without excessive draft loss. It is very probable that additional draft fan costs would offset the investment in alloy tubing, and a closer tube spacing, accomplished, for example, by the tube end swaging previously mentioned, would be justified. Every plant necessitates individual study before a final recommendation can be made.

The check on the tube wall temperatures assumed throughout the discussion requires a knowledge of the film heat transfer coefficient on the inside of the tubes and the thermal conductivity of the metal. The film coefficient and the pressure drop through the tubes are characteristics of the flow of the air. These factors will, therefore, be considered simultaneously as functions of the Reynolds number and by use of the Fanning equation stated in the following forms:

$$Re = \frac{D'G}{\mu} \qquad (7)$$

$$\Delta P = \frac{13.4\ f\ L'\ M^2}{\rho\ d^5} \qquad (8)$$

Re = dimensionless.
D′ = inside diameter of tube, ft.
G = weight velocity, lb. per sq. ft. per sec.

μ = viscosity, lb. per ft. per sec.
ΔP = pressure drop in lb. per sq. in.
f = friction factor, no units.
L′ = total equivalent length of flow, ft.
M = rate of flow in thousands of lb. per hr.
ρ = density lb. per cu. ft.
d = inside diameter in in.

The usual formula for the calculation of overall and intermediate film coefficients, as well as tube wall temperatures, is:

$$U = \frac{1}{\frac{1}{y_g} + \frac{1}{h_w} + \frac{1}{h_a}} \qquad (9)$$

U = the overall heat transfer coefficient B.t.u. per sq. ft. per hr. per deg. F.
h_g = gas film coefficient B.t.u. per sq. ft. per hr. per deg. F.
h_w = thermal conductivity of tube wall.
h_a = air film coefficient B.t.u. per sq. ft. per hr. per deg. F.

The proper values for substitution in formulas (7), (8) and (9) may now be calculated.

The flow of air will be split into 40 parallel streams. Each tube will then carry 9168 lb. per hr.

G = for the 5½ in. diameter tube = 9168 ÷ 3600 × 0.165 = 15.49.

G = for the 4½ in. diameter bends = 9168 ÷ 3600 × 0.110 = 23.07.

Many of the factors occurring in the formulas can conveniently be taken from published charts and Table II will show them at several important temperatures.

The calculations of the tube wall temperatures are approximate, particularly in the radiant section, although an accurate prediction can be made based on assumed values of h_g by comparison with the variation of values of h_a. The tube wall temperature of the shield tubes will be determined, for illustration, based on the following conditions:

Average flue gas temperature, 1800 deg. F.
Average air temperature, 1333 deg. F.
h_g = 12,091,000 ÷ 2300 × 300 = 17.5
h_a = (interpolated table II) = 32.5
h_w = (for chrome-nickel tubes) = 30.0

The overall resistance to heat flow will be equal to the reciprocal of formula (9), or:

$$\frac{1}{U} = \frac{1}{h_g} + \frac{1}{h_w} + \frac{1}{h_a} \qquad (10)$$

$$\frac{1}{U} = \frac{1}{17.5} + \frac{\frac{0.25}{12}}{30\left(\frac{6}{5.5}\right)} + \frac{1}{32.5}$$

$$\frac{1}{U} = 0.057 + 0.0006 + 0.0307 = 0.0883$$

The total temperature difference between the gases and the air is equal to 1800 − 1333, or 467 deg. F.

Temperature drop on the gas side

$$= \frac{0.057}{0.0883} \times 467 = 302 \text{ deg. F.}$$

The outside metal temperature = 1800 − 302, or 1498 deg. F.

Temperature drop on the air side

$$= \frac{0.0307}{0.0883} \times 467, \text{ or } 162 \text{ deg. F.}$$

The inside metal temperature = 1333 + 162, or 1495 deg. F.

It will be seen that the calculated tube wall temperature is in close agreement with the assumed temperature, 1500 deg. F. Similar calculations of tube wall temperatures could be made at any other point but it is believed that the foregoing will illustrate the procedure and the assumed accuracy.

Pressure Drop in Tubes

The pressure drop of the air through the tubes could be calculated by a step by step procedure for each tube pass. It can be accurately predicted, however, by an overall calculation thus:

The air will make 12 passes for which an equivalent length of tube per pass would be 46 ft., allowing for entrance and exit losses. Each return bend will be equivalent to some 35 ft. of tube. The values for substitution in the Fanning equation are as follows:

The inlet pressure required would then become exit pressure of 20 lb. + 5.75 + 10.73, or 36.48 lb. per sq. in.

It would appear from these calculations that the pressure at the compressor would have to be between 40 and 50 lb. per sq. in. to meet the requirements.

The formula recommended for the calculation of the draft loss for the flow of gases over banks of staggered tubes arranged on equilateral spacing is the Genereaux formula published by McAdams.

$$\Delta p_F = \frac{4 f''' \rho n V^2 \text{ Max.}}{2g} \qquad (11)$$

Equation Factors	5.5 in. Tubes	4.5 in. Bends
	0.0049	0.0048
L′	552 ft.	385 ft.
$M^2 = 9.168^2$	83.96	83.96
ρ (assumed)	0.105 lb. per cu. ft.	0.105 lb. per cu. ft.
d^5	5033	1845
ΔP	5.76 lb.	10.73 lb.

Δp_F = pressure drop, lb. per sq. ft.
f′′′ = friction factor.
ρ = density lb. per cu. ft. at average temperature.
n = number of rows of tubes, normal to gas flow.
V = maximum velocity through minimum cross section, ft. per sec.
g = 32.2.

As draft loss is usually measured in inches of water, this formula must be multiplied by 0.192.

The value of f′′′ must be figured from the equation:

$$f''' = 0.8\left(\frac{aV \text{ max. } \rho}{\mu}\right)^{-0.22}, \qquad (12)$$

in which:
a = clearance between tubes in ft.
μ = viscosity at average temperature.

The calculated values to be substituted in equations (11) and (12), applicable to the shield tubes and the convection tubes, are:

Substituting these values in equation 12, we find that the draft loss in H_2O for the shield tubes is 0.036, and that for the convection tubes is 0.525.

The total draft loss through the tube banks is, therefore, 0.561 in. of water, which is satisfactory for a furnace of this design. It also supports the suggestion that the tube spacing in the convection section might be further reduced with a considerable saving in construction and operating cost.

It should be observed that the total heating surface is 27,504 sq. ft. and this unit in practice would meet the requirements of a modern 1000-ton blast furnace. The type of furnace suggested should merit consideration when compared with a modern blast furnace installation which would require not less than three conventional stoves, about 24 ft. in diameter by 100 ft. high, containing approximately 200,000 sq. ft. of refractory surface per stove.

It is not suggested that the apparatus transfer are confined to or even best application of the principles of heat

	Shield Tubes	Convection Tubes
Tube size, o.d., in.	6	6
Tube spacing, in.	10	9
Clearance, a, in.	4	3
Number of rows, n	2	20
Average temperature of flue gases, deg. F.	1800	1450
ρ at average temperature, lb. per cu. ft.	0.019	0.0224
μ at average temperature, lb. per ft. per sec.	0.000036	0.000031
V maximum average temperature, ft. per sec.	25.3	28.6
f′′′ calculated	0.1256	0.1208
$\Delta P'$ calculated, lb. per sq. ft.	0.19	2.74
Total draft loss, in. H_2O	0.036	0.525

adapted to furnaces of the size illustrated. The performance characteristics selected were based on the air requirements for a large and modern blast furnace. In practice it might be advisable to design two or more smaller units instead of one large one. The use of alloy tubes in furnaces of this type is by no means an untried suggestion as the petroleum industry has similar units in service. These units are not as large as the furnace discussed, but they are indeed comparable.

It should be mentioned that any furnace constructed in the manner suggested and operated under similar working conditions should be well protected by safety devices so as to prevent any possibility of burning out expensive tubing. There are numerous reliable automatic controls available and if the petroleum industry experience might be recommended, these safety devices will be found to be good investments.

Nomenclature

a = clearance between tubes in ft.
A_c = circumferential tube surface, sq. ft.
A_r = effective refractory surface, sq. ft.
A_s = equivalent surface per sq. ft. of actual circumferential tube area, sq. ft.
A_t = total area of the furnace surfaces in the combustion chamber, sq. ft.
A_{cp} = equivalent cold plane surface, sq. ft.
α = ratio of radiant heat reception by the tubular surfaces to reception by a continuous plane.
αA_{cp} = Area of a plane which will absorb the same amount of heat as the actual cold surface in the combustion chamber, sq. ft.
C_g = radiation due to carbon dioxide at the gas temperature, B.t.u. per sq. ft. per hr.
C_s = radiation due to carbon dioxide at the mean tube wall temperature, B.t.u. per sq. ft. per hr.
d = inside diameter of the tube, in.
D = outside diameter of the tube, in.
D' = inside diameter of the tube, ft.
E_c = Emissivity of carbon dioxide component of combustion products.
E_w = emissivity of water vapor component of combustion products.
F_{rc} = the fraction of all the radiation emitted from all the refractory in all directions, which, if not absorbed by the gas, would hit upon cold surfaces, αA_{cp}.
F_s = angle emissivity factor.
f = friction factor in Fanning equation.
f''' = friction factor in Genereaux equation.
G = weight velocity, lb. per sq. ft. per sec.
g = 32.2.
h_a = air film coefficient B.t.u. per sq. ft. per hr. per deg. F.
h_c = convection coefficient B.t.u. per sq. ft. per hr. per deg. F.
h_g = gas film coefficient B.t.u. per sq. ft. per hr. per deg. F.
h_w = thermal conductivity of tube wall.
K = per cent correction due to superimposed radiation of carbon dioxide and water.
K_g = correction due to superimposed radiation of carbon dioxide and water at the mean radiating gas temperature, B.t.u. per sq. ft. per hr.
K_s = correction due to superimposed radiation of carbon dioxide and water at the mean tubular surface temperature, B.t.u. per sq. ft. per hr.
L = mean radiating beam length of combustion products, ft.
L' = total equivalent length of flow, ft.
M = rate of flow in thousands of lb. per hr.
n = number of rows of tubes, normal to gas flow.
p_c = partial pressure of carbon dioxide, atmospheres.
P_f = emissivity of flame.
P_s = emissivity of the heat receiving surfaces.
P_w = partial pressure of water vapor, atmospheres.
q = net heat transferred by radiation and convection to the radiant section tubes, B.t.u. per hr.
q' = heat transferred by forced convection, B.t.u. per sq. ft. per hr.
q'' = heat transferred by radiation in convection section B.t.u. per hr.
T = mean temperature of the flue gases in the convection section, deg. Rankine.
T_g = mean temperature of the hot gases in the combustion chamber, deg. Rankine.
T_s = Mean tube surface temperature, deg. Rankine.
t_{g1} = inlet gas temperature, convection section, deg. F.
t_{g2} = outlet gas temperature, convection section, deg. F.
t_{s1} = tube wall temperature at air inlet, convection section, deg. F.
t_{s2} = tube wall temperature at air outlet, convection section, deg. F.
U = overall heat transfer coefficient between the products of combustion and the air being heated, B.t.u. per sq. ft. per hr. per deg. F.
V = maximum velocity through minimum cross section, ft. per sec.
W_g = radiation due to water vapor at the gas temperature B.t.u. per sq. ft. per hr.
W_s = radiation due to water vapor at the mean tubular surface temperature, B.t.u. per sq. ft. per hr.
Re = Reynolds number (no units).
ϕ = an overall exchange factor correcting for flame emissivity, arrangement of the refractory, volume of the combustion chamber, etc.
ΔT_M = logarithmic mean temperature difference, deg. F.
μ = viscosity, lb per. ft. per sec.
ρ = density, lb. per cu. ft.
ΔP = pressure drop, lb. per sq. in.

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TABLE II

Factors Used in Formulae (7), (8), and (9)

d	Temperature, deg. F.	G	μ	Re	f **	h_a *
5.5	100	15.49	0.0000128	555,000	0.0047	25
5.5	800	15.49	0.0000215	330,600	0.0049	30
5.5	1500	15.49	0.0000302	235,300	0.0050	35
4.5	100	23.07	0.0000128	675,800	0.0046	37
4.5	800	23.07	0.0000215	402,300	0.0048	40
4.5	1500	23.07	0.0000302	286,400	0.0050	50

* McAdams, Fig. 67, alignment chart.
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(Concluded on Page 109)

TABLE I

Illustrative Problem

AIR HEATER RATING:

Capacity, 80,000 cu. ft. per min. free air at 60 deg. F., and 14.7 lb. absolute pressure
Air temperature in = 100 deg. F.
Air temperature out = 1400 deg. F.
Air pressure in = 36.48 lb. per sq. in. gage
Air pressure out = 20 lb. per sq. in. gage

FUEL, BLAST FURNACE GAS (Dust Removed):

Specific gravity ..... 1.02 (air = 1.0)
Net calorific value ..... 91.75 B.t.u. per cu. ft.
Analysis by volume:
CO_2 = 11.5 per cent
N_2 = 60.0 per cent
CO = 27.5 per cent
H_2 = 1.0 per cent
Air for combustion, 30 per cent excess
Extraneous moisture, sufficient to reduce theoretical flame temperature to 2100 deg. F., or 0.165 lb. per lb. fuel.

PRODUCTS OF COMBUSTION:

dry CO_2 = 22.50 per cent
wet CO_2 = 19.25 per cent
H_2O = 14.20 per cent

Lb. moisture per 100 standard cu. ft. of flue gas	0.296
Standard cu. ft. wet flue gas per standard cu. ft. fuel gas	2.02
Standard cu. ft. wet flue gas per lb. fuel gas	25.95
Lb. wet flue gas per lb. fuel gas	2.037
Density wet flue gas	0.0785 lb. per cu. ft.

AIR HEATER CONSTRUCTION DATA:

Combustion chamber, 17.5 × 17.5 × 36.5 ft.
Combustion chamber, volume, 11,178 cu. ft.
Tubes, 6 in. OD × 5.5 in. ID × 36.5 ft., effective length.
Tube return bends, 5.5 in. OD × 4.5 in. ID.
Tube spacing, radiant roof and walls, 10 in. center to center, single row.
Tube spacing, shield, 10 in. center to center, two rows, staggered
Tube spacing, convection, 9 in. center to center, 20 rows, staggered.

Number of roof tubes and total surface area	20	1,146 sq. ft.
Number of wall tubes and total surface area	20	1,146 sq. ft.
Number of shield tubes and total surface area	40	2,292 sq. ft.
Number of convection tubes and total surface area	400	22,920 sq. ft.
Total number of tubes and total surface area	480	27,504 sq. ft.

DESIGN DATA:

Net reduced flame temperature	T_g =	1,800 deg. F.
Mean tube wall temperature, roof tubes	T_r =	1,100 deg. F.
Mean tube wall temperature, wall tubes	T_s =	1,100 deg. F.
Mean tube wall temperature, shield tubes	T_s =	1,500 deg. F.
Flue gas temperature leaving air heater		1,100 deg. F.
Volume of air to be heated		80,000 cu. ft. per min.
Air density		0.0764 lb. per cu. ft.

Total weight of air, 80,000 × 60 × 0.0764 = 366,720 lb. per hr.
Temperature range, 1,400 deg. F. −100 deg. F. = 1,300 deg. F.
Average specific heat, 0.244 B.t.u. per lb. per deg. F.
Air heater duty, 366,720 × 1,300 × 0.244 = 116,324,000 B.t.u. per hr.

HEAT BALANCE WET BASIS:

B.t.u. per standard cu. ft. of fuel at 2,100 deg. F.			93.00 (Fig. 1)
Radiation loss, assumed 3 per cent			2.79
B.t.u. per standard cu. ft. of fuel in flue gases at 1,100 deg. F.			44.18 (Fig. 1)
B.t.u. per standard cu. ft. of fuel absorbed in heating air (by difference)			46.03
Air heater efficiency, 46.03 ÷ 93.00			49.5 per cent
Total heat release	116,324,000 ÷ 0.495	=	235,000,000 B.t.u. per hr.
Fuel gas required, standard cu. ft. per hr.	235,000,000 ÷ 93	=	2,526,000
Standard cu. ft. flue gases per hr., wet	2,526,000 × 2.02	=	5,102,500
Lb. flue gases per hr., wet	5,102,500 × 0.0785	=	400,500
Heat release per cu. ft. of furnace volume	235,000,000 ÷ 11,178	=	21,000 B.t.u. per hr.

Foundrymen Set War Goal

FACED with the responsibility of producing 15,000,000 tons of castings this year, foundrymen from the United States, Canada and South America assembled last week in Cleveland for the 46th annual convention of the American Foundrymen's Association to exchange ideas on ways and means of producing this record breaking tonnage of essential war material.

Despite the pressure of plant duties, attendance at the meeting was well up to past conventions. As a matter of fact, many exhibitors expressed the opinion that the number of brass hats attending was much greater than usual.

Against a background of pleas by government officials for more production, close to 50 technical sessions were held covering practically every phase of foundry operation, from such problems as risering practice to costing techniques.

One of the liveliest topics for lobby discussions was the use of cast iron and steel for bomb making and gun barrel manufacture. Some very remarkable research work is being accomplished in these respects and some developments have already reached the practical stage. Censorship, however, prevents an extended discussion of the details of this progress.

One point, nevertheless, can be emphasized, and that is that the current achievements of foundry metallurgists and technicians to meet the new war demands is giving rise to a new conception of the scope of casting which is bound to have very substantial repercussions on the competitive position of castings after the war.

Tolerances which have heretofore been considered as laboratory dreams have become a very earthy reality; physical characteristics are being obtained that come close to meeting some of the ridiculous demands which buyers in the past have demanded of castings. Keeping pace with this metallurgical progress, production methods have also been subjected to improvements which greatly increase the production possibilities of a given floor area.

The foundry industry's goal of 15,000,000 tons for 1942 was set by H. S. Simpson of National Engineering Co., retiring president of the association, in an address at the annual business meeting on Wednesday. Mr. Simpson pledged the close to 5000 members of the association and its 23 chapters to the fulfillment of this demand. The retiring president's pledge was enthusiastically endorsed by an unanimous voice vote to support the War Production Board to its fullest extent.

Forbes Elected President

D. P. Forbes of Gunite Foundries Corp. was elected president of the association at the annual meeting and L. C. Wilson of Reading Steel Casting Division, American Chain & Cable Co., Inc., was chosen vice-president. New directors elected include J. E. Crown, master mechanic at the U. S. Naval Gun Factory, Washington, D. C.; I. R. Wagner, general manager of Electric Steel Castings Co., Indianapolis; S. V. Wood, president and general manager of Minneapolis Electric Steel Castings Co., Minneapolis; W. L. Woody, manager of National Malleable & Steel Castings Co., Sharon, Pa., and V. Reid, president of City Pattern Works, Detroit. Mr. Reid was selected to fill the vacancy caused by the recent death of director W. J. Corbett.

In recognition of their important contributions to the foundry industry, the AFA this year presented

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Brazilian Foundrymen at AFA Convention

• • • These three Brazilian foundrymen, who attended the AFA convention last week in Cleveland, lent a Pan-American atmosphere to the gathering. They are, left to right, Dr. Miguel Siegel, head of the the Instituto de Pesquisas Technologicas of Sao Paulo, Heraldo de Souza Mattos of Rio de Janeiro, and Horace A. Hunnicutt, Industrias Chemicas Brasileiras, Sao Paulo. Mr. Hunnicutt is associated with a distributor of the International Nickel Co.

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awards to A. L. Boegehold, J. E. Galvin, R. M. Allen and P. Dwyer. Boegehold, chief metallurgist of General Motors Research Laboratories, Detroit, received the J. H. Whiting gold medal, and Galvin, president of the Ohio Steel Foundry Co., Lima, O., was awarded the John A. Penton gold medal. Allen, the well known consulting metallurgist of Bloomfield, N. J., and Pat Dwyer, engineering editor of *The Foundry*, were both awarded life memberships in the AFA.

The urgent demands of war plants for equipment acted to reduce somewhat the number of working exhibits on display at the equipment exhibition, which was held at the Cleveland auditorium simultaneously with the technical sessions. The problem faced by so many manufacturers was admirably summed up by a sign at the W. W. Sly Mfg. Co. The sign read: "100 per cent on war work. We regret that due to the large volume of urgent orders we are unable to spare equipment for exhibiting purposes. If you would like to see our equipment, we shall be glad to see you at our plant."

To make up for the absence of the usual amount of equipment, the exhibitors did a first rate job in having their technical experts on hand to consult with attending foundrymen. Many foundry executives expressed the opinion to the observer that they had accomplished more in two days at the convention by going from booth to booth than in two weeks of plant calls.

This consulting service, which was shared by a number of government agencies, was of particular value to plants converting to war work, for it enabled them to obtain a complete picture of the equipment they required and to find the answers to some of the technical problems facing them.

One WPB official after making the rounds of the exhibition halls, said that the consulting facilities provided by the exhibitors, plus the swapping of ideas at the technical meetings, advanced the foundry industry's war program at least six months ahead of what it would have been forced to rely on normal individual contacts to obtain necessary information.

The first step toward establishing closer contact between foundrymen in North and South America was taken at this convention. A Western Hemisphere foundry conference was held on Monday evening, with a number of foundrymen from the Southern Republics presenting discussions of foundry practice there. After the technical session, which was lent an international atmosphere by the fact that the meeting was presided over by a Canadian, Harold J. Roast, of Canadian Bronze Co., Ltd., Montreal, an animated discussion was carried on concerning the possibility of either establishing an AFA chapter in Brazil, or providing necessary recommendations and technical aid for the formation of an independent Brazilian foundry group.

AFA officers stressed that their interest was in providing a means for an exchange of technical information between North and South America and the mechanism through which this could be accomplished was secondary to the actual dissemination of technical data.

DUNCAN P. FORBES

• • • The heavy responsibility of guiding the activities of the American Foundrymen's Association through the complexities of war times has been placed upon the youthful shoulders of Duncan P. Forbes, president and general manager of Gunite Foundries Corp., Rockford, Ill. Mr. Forbes' election last week in Cleveland to the presidency of the AFA culminates an extensive period of valuable association work.

In 1941 Mr. Forbes was chosen vice-president, after having served a three-year term as a director and one year as a member of the board's executive committee. He played an important role in the organizing of the Illinois-Southern Wisconsin chapter and has been a member of the Malleable Division of AFA since its formation in 1932. In addition to holding numerous other AFA offices, Mr. Forbes has made many important contributions to foundry technology in the form of technical papers and talks before various chapters.

Springing from a long line of foundrymen, he has acquired, the hard way, an unusually comprehensive knowledge of foundry problems. In 1921 he became associated with the Rockford Malleable Iron Works as molder, advancing rapidly through such positions as junior metallurgist, molding foreman and finally works manager. It was Mr. Forbes who directed the research work which led to the development of Gunite metal. A graduate of Yale, he also spent some time in the laboratory of Professor Enrique Touceda of Albany, studying the metallurgy of malleable iron.

Shop Courses Popular

The shop courses, which by popular demand have now become an annual affair, were particularly well received. The sand shop course was under the leadership of W. G. Reichert of American Brake Shoe & Foundry Co., while the gray iron shop course, which dealt largely with shrinkage, was under the chairmanship of K. H. Priestley of Eaton-Erb Foundry Division, Eaton Mfg. Co.

An outstanding feature of the malleable division was a symposium on graphitization, presided over by H. A. Schwartz of National Malleable & Steel Castings Co.

Despite the difficulty of war time travel, a number of foundrymen from South American Republics attended the convention and participated in the Pan American conference on Monday. The visitors also presented several papers dealing with founding in the various Southern Republics.

While space limitations do not permit an adequate discussion here of all the excellent papers read at the convention, copies of the papers can be obtained by addressing the American Foundrymen's Association, 222 West Adams Street, Chicago.

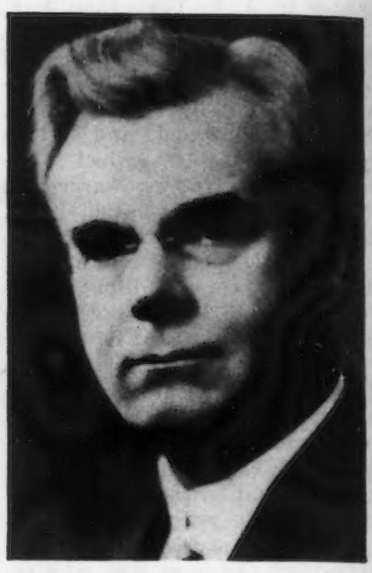
Gating and Risering

Steel men attending the technical sessions evinced especial interest in a paper prepared by H. F. Taylor and E. A. Rominski of the Naval Research Laboratory at Anacostia, entitled "Atmospheric Pressure and the Steel Casting — a New Technique in Grating and Risering."

The author's interest in this subject originally arose from conversations with executives of the Dodge Steel Co., which had developed a practical, patented method of taking advantage of atmospheric pressure when using blind risers. After studying the technique of the Dodge company, the two authors

A. L. BOEGEHOLD

J. E. GALVIN



R. M. ALLEN

P. DWYER

Receive AFA Awards

• • • Recognition of their important contributions to the art of foundry was granted this year by the AFA Board of Awards to the following: The J. H. Whiting gold medal to A. L. Boegehold, chief metallurgist, General Motors Research Laboratories, Detroit; the John A. Penton gold medal to John E. Galvin, president, Ohio Steel Foundry Co., Lima, O.; honorary life membership to Roy M. Allen, consulting metallurgist, Bloomfield, N. J., and to Pat Dwyer, engineering editor of The Foundry.

undertook a study of the effect of atmospheric pressure at the Naval Research Laboratory. Their work is particularly valuable in that they have established the whys and wherefores of the behavior of metal in risers which in the past have been left largely to a by-guess and by-god science.

The paper confirms the Dodge company's experience that the most important factor in the successful application of blind risering is that of keeping the riser open so that atmospheric pressure may work upon the liquid metal in the riser.

As the authors point out, the use of blind risers is now a new development. But the better understanding of the principles of blind risering arising out of the data contained in the paper, plus the device for keeping the riser opened to the atmosphere*, should be of great value to the steel foundry industry.

Rominski and Taylor state that when blind risering, it is quite possible that instead of the riser feeding the casting, the reverse can happen, resulting in a defective casting. This occurs when gravitational and atmospheric forces are not properly utilized. A number of experiments conducted by the authors proved this point.

On the other hand, it is pointed out that under ideal conditions, and assuming the existence of a perfect void in the casting cavity, it would be possible to force steel upward to a height of slightly greater than four feet.

Figs. 1 and 2 show the use of a small core, the method patented by Dodge, for keeping the blind riser open. In both cases, the sketch to the left shows the casting partly solidified, while the right hand sketch shows the casting fully solidified. Fig. 3 illustrates the method of making keel blocks with a blind riser.

Dodge Method

The method employed successfully by Dodge on a large variety of castings consists of imbedding a round dried sand core in the sand at the top of the riser so that it extends into it for a distance roughly equal to the radius of the riser. This core is a simple rod core of a type found in the average foundry, except that a small vent hole extends through the center. This vent hole, the authors said, was not absolutely necessary, but is recommended. The important point is that the core be sufficiently strong and refractory to withstand the pressure and temperature of the molten metal and permeable enough to allow passage of gas.

In action this core breaks the seal which otherwise would form completely over the riser by extending

** This device has been patented by John Williams of Dodge Steel Co., Tacony, Pa. U. S. patent No. 2,205,327, dated June 18, 1940.*

J. E. CROWN

I. R. WAGNER

S. V. WOOD

New AFA Directors

• • • New members of the board of directors of the American Foundrymen's Association, elected at the convention last week in Cleveland, are J. E. Crown, master mechanic, U. S. Naval Gun Factory, Washington, D. C.; I. R. Wagner, general manager, Electric Steel Castings Co., Indianapolis, Ind., S. V. Wood, president and general manager, Minneapolis Electric Steel Castings Co., Minneapolis; W. L. Woody, manager, National Malleable & Steel Castings Co., Sharon, Pa. In addition to filling these regularly vacant chairs, V. Reid, president of City Pattern Works, Detroit, was chosen to complete the unexpired term of W. J. Corbett, who died recently.

W. L. WOODY

into the center of the riser where there is still liquid metal. This permits atmospheric pressure, acting through the permeable core, to force the metal from the riser into the partial vacuum tending to form within the casting proper. The authors report that the sand of the mold is sufficiently permeable to allow an easy passage of gas to and from the core.

The paper relates that in addition to the method described here, there are several other ways of keeping a blind head open. A sharp wedge of sand may be molded into the top part of the riser and in many cases this method is satisfactory. The sharp edge of the sand furnishes a necessary hot spot, but cold metal and late feed demand may combine to cause this method to be ineffective.

The use of thermit, either made up as a core or held in readily melted tubes placed at the top of the riser has been found satisfactory by some foundrymen and, according to the authors, actually increases the efficiency of blind risers by the exothermic addition of heat. This material, however, is expensive and hence this method will probably not become popular.

These two methods and various others were tried at the Naval Research Laboratory, but none appeared to function with the same degree of certainty and simplicity as the core developed by Dodge.

The advantages of the proper use of blind risering were listed in the paper as being: hotter feed metal, generally cleaner castings, lower cleaning cost, increased yield through more economical feeding, and more solid castings through a better understanding of the risering process.

Rominski and Taylor stress that bottom gating is fully practical and, in fact, is preferred whether blind or open risers are used, because there is less erosion of sand surfaces and the metal is generally cleaner.

Among the disadvantages of the use of blind risers listed in the paper are the necessity of using larger flasks and the fact that dirt or dross may be trapped in the main body of the casting as no open riser is present into which it can collect. Good sand practice, however, is said to largely eliminate this disadvantage.

The Dodge Steel Co. in technical literature issued by it (not discussed in the paper by Taylor and Rominski) claims that the increased average yield per melt, occurring from the use of blind risering by the Williams method, is as high as 4 points, or about 10 per cent more salable products per melt. Reduced returns from customers, the company claims, is also an important advantage, running currently under ½ of 1 per cent in Dodge's own production. This method of blind risering is asserted to be of espe-

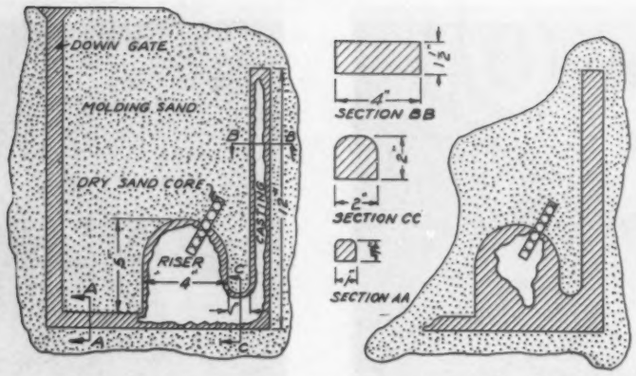
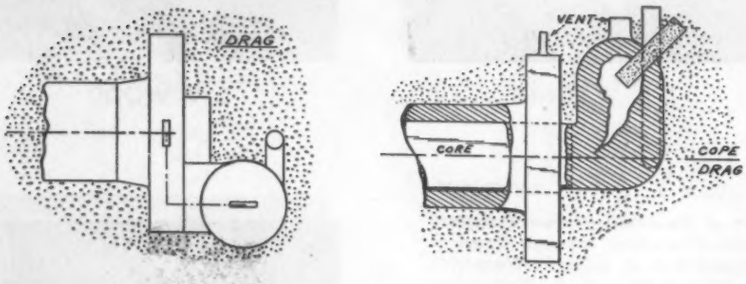


Fig. 1—Schematic drawing of mold and casting to illustrate the principles of blind heading. AA is the down gate and CC is the neck. The sketch on the left shows the metal partly solidified and on the right completely solidified.



ABOVE

Fig. 2—Top (left) and side (right) view of a typical use of blind risering. The casting is a valve flange. Note the Dodge venting core in the riser.

o o o

LEFT

Fig. 3—Keel block castings made with a blind riser.

cial value in feeding thin sections and hard-to-reach parts. Some 15 foundries have been licensed by Dodge to make use of the Williams process.

Welding Aluminum Castings

The efficiency of welding as a means of reclaiming defective aluminum castings was discussed in a paper entitled "Salvage and Reclamation of Aluminum Alloy Castings by Welding" by A. T. Ruppe and A. J. Juroff, assistant foundry superintendent and metallurgist respectively, of the Products Division of Bendix Aviation Corp.

Pointing out the lack of specific information on the physical properties of welded casting aluminum alloys, the authors described the results of their experiments to determine the type of foundry defect that can be welded and the quality of the weld that can be expected when the work is done by an experienced welder.

The test bars used in the experiments were cast in green sand molds, according to U. S. Army Ordnance specification No. 57-72. About half the test bars of each alloy were cut in half, single V-notched or double V-notched and then welded together. Each bar was welded with a rod having the same nominal chemical composition.

After welding, the No. 195 and 355 bars were heat treated, the 355 bar being given a 16-hr. solution treatment at 980 deg. F., a hot water quench and artificial aging at 325 deg. F. for 6 hr. The 195 bars were given a solution treatment of 18 hr., a hot water quench and were aged at 300 deg. F. for 4 hr. All the test bars were radiographed before the tensile test and bars which could not pass an ordinary radiographic inspection were discarded. Welding procedure used followed as closely as possible that recommended by the Aluminum Co. of America. The test bars were preheated to between 600 and 700 deg. F. before welding.

The tests run on No. 43 as-cast bars showed an average tensile strength of 17,090 lb. per sq. in. and an average elongation of 3.85 per cent in 2-in. The welded bars averaged 17,000 lb. per sq. in. with an elongation of 4 per cent in 2 in.

From these series of tests, the authors drew the conclusion that "welded test bars are so nearly as strong as the 'as-cast' bars that the difference can be disregarded." Microscopic examination of the welded test bars showed, in every case, that the weld metal was much finer grained than the parent metal.

Ruppe and Juroff explained this fineness by pointing out that welding is actually a casting process in which the sides of the piece to be joined form the mold. The thermal conductivity of the metal forming the mold is high and the weld metal is rapidly chilled as it is deposited. The No. 43 alloy (5 per cent Si) has a relatively narrow melting range and a comparatively high fluidity and these characteristics enable the weld metal to fill the "mold" completely and to freeze rapidly. In this manner, the authors stated, the inherent characteristics of the metal combine with the welding process to produce the fine grained structure.

Tests on the heat treated No. 355 alloy bars showed an average for the as-cast bars of 36,185 lb. per sq. in. in tensile strength and 1.8 per cent elongation in 2 in., while the welded bars averaged 32,320 lb. tensile and 1.3 per cent elongation.

The welded specimens of the 355 alloy averaged about 88 per

AFA VICE-PRESIDENT

L. C. Wilson, Reading Steel Casting Division of American Chain & Cable Co., Reading, Pa., was elected vice-president of AFA last week in Cleveland.

RETIRING PRESIDENT

H. S. Simpson, National Engineering Co., Chicago, who served as president of AFA in 1941-1942, has been elected a member of the board of directors.

cent of the as-cast strength. This average was lowered somewhat by the fact that one bar was defective in the weld area and another broke in the fillet.

The tests on the No. 195 alloy showed an average tensile strength of 33,275 lb. per sq. in. for the as-cast bars and 27,265 lb. for the welded specimens. Elongation for the as-cast bars averaged 4.5 per cent in 2 in. and in the welded bars 2.3 per cent. This alloy, the 195, showed the greatest difference in the strength between the as-cast and the welded units, the average loss in strength of the welded bars amounting to about 18 per cent.

Summarizing their work, Ruppe and Juroff report that it is possible to repair defects in No. 43 aluminum alloy sand castings and to obtain, in the welded region, physical properties equivalent to those of the parent metal. Castings of alloys 355 and 195 can also be repaired by welding, but a slight loss in strength is to be expected, even if the castings are heat treated after welding. It is important, the authors stated, that all castings repaired by welding should be radiographically inspected to insure sound welds.

Tin Bronzes

Another report in the series of recommended practices being prepared by the Non-Ferrous Division of AFA was presented at the meeting, this latest report covering "Tentatively Recommended Practices for Sand Cast Tin Bronzes" (preprint No. 42-4). While this report is not recommended as a specification, the information is compiled by specialists in the tin bronze field and is of high practical value. The tin bronze report covers such subjects as fundamental metallurgy, molding practice, melting and pouring, fluxing and deoxidizing, heat treatment, properties and applications and the cause and prevention of defects.

Carbon Determination

A method for making a direct determination of combined carbon in cast iron and steel in 15 min. was described by J. G. Donaldson, research engineer of Battelle Memorial Institute. The present accepted method of determining combined carbon, Donaldson pointed out, consists of determining total carbon and graphitic carbon, with the combined carbon being the difference between these two values. This method, he said, has the disadvantage of requiring hours rather than minutes to perform, and the entire burden of error is thrown on the combined carbon figure.

A complete list of the papers presented at the AFA convention was published in The Iron Age, *April 9, 1942, p. 61. Copies of these papers may be obtained from the American Foundrymen's Association, 222 West Adams St., Chicago.—Ed.*

Donaldson's method consists of solution of the sample in a dilute nitiric-sulphuric-phosphoric acid mixture, containing a small amount of silver nitrate as a catalyst. Oxidation of the combined carbon is accomplished by boiling with a hot solution of ammonium persulfate, and passing the evolved carbonaceous gases through heated copper oxide. After removal of sulphur gases and water, the evolved carbon dioxide is absorbed in ascarite and weighed. The procedure is carried out in a closed system to prevent escape of any organic gases evolved in dissolving the sample.

The experiments covering steels containing small amounts of alloying materials gave good results, except in the case of chromium steel. One per cent chromium in the steel was found to defeat the determination, as the metal was not completely dissolved in the acid and the results were low. The following table gives a comparison of results obtained with currently accepted methods and the procedure developed by Donaldson:

BUREAU OF STANDARDS STEEL SAMPLES

B. of S. Sample No.	Combined Carbon, Per Cent — Bureau of Standards Certificate Results: Maximum	Minimum	Recommended Value	New Method***
16c	1.02	1.00	1.01	0.97
16c	1.02	1.00	1.01	1.01
20d	Provisional Certificate		0.411	0.430
20d	Provisional Certificate		0.411	0.434
9c	0.206	0.198	0.202	0.202
9c	0.206	0.198	0.202	0.206
130	0.460	0.448	0.454 (Pb steel)	0.480
30c	0.503	0.481	0.489 (Cr-V steel)	0.306**
111	0.207	0.196	0.202 (Mo-Ni steel)	0.213

* Milliliter.
** Chromium steel not soluble in the acid mixture used.
*** Developed by Battelle Memorial Institute.

Rejuvenating An Old Miller

PART of the difficulty encountered in expanding production of machine tools by the several hundred per cent desired lies in the fact that it takes machine tools to make machine tools. One solution to the problem of production has been to rehabilitate old machine tools where possible.

Wholly aside from the accelerated rate of production which today makes it feasible to recondition many old machines, there are some instances where the rehabilitated lathe, planer, or milling machine goes back into useful service actually improved in several respects over the original unit. Frequently, the ability to provide an old machine tool with a wider range of operating speeds will contribute materially to the success of the rebuilt job.

A case in point is the way in which Continental Machines, Inc., Minneapolis, purchased an old Becker vertical milling machine, rebuilt it, and by applying the new all-electric, adjustable-speed drive developed by the Reliance Electric & Engineering Co., Cleveland, obtained a piece of equipment capable of performing to better advantage than when it was new.

Rebuilt specifically to handle heavy milling operations on cases and covers of transmission housings for the company's Doall contour sawing machines, the vertical milling unit has a new flexibility that adapts it to a number of additional machining jobs. By simply turning the small knob on the speed adjuster of the new drive, which in the accompanying illustration can be seen on the wall to the right and above the V*S unit, a wide range of spindle speeds is made available. Five speeds are regularly in use on the machine, with an infinite number of additional speeds available between each of the points indicated by chalk marks.

The d.c. driving motor is belt-connected to a three-step cone drive which was part of the original equipment of the milling machine. The range of tools which can be used in the milling machine now extends from a ½-in. end mill up to an 8-in. end mill.

Colloidal Graphite Cuts Assembly Time

SEVERAL companies are saving time on precision assembly operations by coating the mating surfaces with Oildag colloidal graphite, it is reported. Two types of operations lend themselves especially well to this treatment. One is that where hand scraping, lapping or grinding are usually used, where fits are close. A second type of assembly where the method is useful is on aircraft engines.

Many aircraft engine parts, machined to fine tolerances, are sorted according to variations in size, in steps of a few ten-thousandths of an inch. This is followed by selective assembly of similarly close tolerances for the fits of mating parts. In such cases parts which might otherwise gall from metal to metal contact during the breaking in period are now being assembled with mineral oil carrying a colloidal graphite dispersion. This procedure reduces the possibility of abrading the surfaces when fits are extremely close, or where the tolerances tend to run on the "tight" side.

The procedure also offers an opportunity of reducing the number of stepped sizes as well as the number of selections required to obtain the desired fit between mating parts. It may also permit certain assemblies to be made even though inexperienced operators have failed to work to the close limits required.

According to the manufacturer, Acheson Colloids Corp., Port Huron, Mich., the value of the colloidal graphite in these applications is due to its ability to adhere to and be adsorbed by the metal under normal pressures and thus provide a dry-lubricating graphite film protecting surfaces even when oil lubrication becomes scanty.

The Country Club's new tractor is protecting the Panama Canal

If the fairways of the Country Club are a little rough in spots, members can add a stroke or two and blame it on the Japs. For the materials to produce the new tractor that was going to pull the club's gang of lawn mowers are now in a tractor somewhere in Panama, hauling a heavy gun. Either there or on our farm lands, helping a farmer grow bigger crops. Between them, Private Brown and Farmer Brown get all the new tractors there are.

In this war of blitz and counter-blitz, big guns must have the mobility of tanks. That means a tractor for every heavy gun. Add to these the thousands of tractors our farmers must have, and it is easy to see why the tractor manufacturers must strain every resource to fill the need.

In doing so, they smoothed out important production tasks in cooperation with the Revere Technical Advisory staff. For in all problems of copper and its alloys Revere provides a service, as well as metals, that can make manufacturing operations quicker and easier.

Every ounce of copper and brass our country can produce is needed to win the war. None can be spared for any other use. But Revere is especially well equipped with new plants, improved machines, advanced processes to supply a heavy share of these vital metals. And more facilities are rapidly being added to help get the war won *soon*.

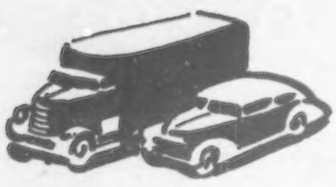
The Revere Technical Advisory Service functions in (1) developing new and better Revere materials to meet active or anticipated demands; (2) supplying specific and detailed knowledge of the properties of engineering and construction materials; (3) continuously observing developments of science and engineering for their utilization in production methods and equipment; (4) helping industrial executives make use of data thus developed. This service is available to you, free.

REVERE COPPER AND BRASS INCORPORATED

EXECUTIVE OFFICES: 230 PARK AVENUE, NEW YORK

Assembly Line . . .

• Murray Corp. hits maximum production level on aircraft and tackles new war jobs . . . George T. Christopher elected president of Packard . . . S.A.E. war engineering board adds members to stem flood of war assignments .



DETROIT—Last week, at just about the time that Murray Corp. of America revealed it had hit its maximum production level a full 11 weeks ahead of forecast date, there was revealed more detail on the extensive work required to change this former auto body manufacturer into a major sub-contractor to the aircraft industry.

Murray was one of the early firms to get started and, as a result, is one of the early firms to reach a high level of production. As reported here during the late fall months, the company began then to make its first shipments of parts to aircraft prime contractors after a long period of tooling and much delay incurred because aircraft designs were changed to meet modern up-to-the-minute warfront demands.

Prior to 1940 Murray was engaged principally in the manufacture of auto bodies, frames and parts, especially side panels and other parts that made the Ford body. It made its preparations then to swing over into war work. Actually, the first announcement that it would obtain an aircraft order came from Douglas on Oct. 25, 1940, the date on which the automotive industry held a meeting here with Knudsen to discuss the general participation of the industry in such a program. The Murray contracts to do this work were not signed until well into 1941, however, and it was in the fall months of 1941 before any deliveries were possible. Now the last auto body panels have traveled the length of the conveyor lines—months ago—and their places have been taken by rows of aircraft wings and other similar parts.

A COMPARISON of the two kinds of jobs is given by Murray. The making of automotive panels required 100 to 200 stampings and the utilization of 50 to 400 parts classified as "standard." These latter included nuts, bolts, rivets, etc. A pair of wings now traveling on the aircraft assembly lines requires more than 5400 parts, with an additional 1500 standard parts, including 500 different types and sizes of rivets, of which 55,000 go into the manufacture of a single set of wing panels.

Another indication of the magnitude of the aircraft conversion job is the number of tools made by Murray to build wings on just one of the contracts it now has. Requirements included 1393 dies, 1838 jigs and fixtures, 1688 templates and patterns and 108 other tools, including routers and gages.

The building of these tools, dies, jigs and fixtures consumed 725,000 man hours, without including hours expended on purchased or furnished tools. The tooling has not ceased, because constant improvements in plane design necessitate regular tooling changes so a continuous program is underway.

Another basis of comparison between peacetime operations and wartime needs is supplied by Murray data on tooling for Ford subcontract work and Douglas aircraft work. The Ford contract requires 109 dies and 74 jigs and fixtures, largely for stainless steel fabrication, while the Douglas figures are almost 28 times as great.

During the past year employment has increased almost 1700 per cent. Of Murray's former automotive workers, 95 per cent currently are working on armament orders and this figure will reach 100 per cent on May 31 when the last of civilian production on household appliances is completed. Included in the newly hired workers are a large number, approximately one-quarter of the increase, who have passed through special training programs in a Murray aeronautical school.

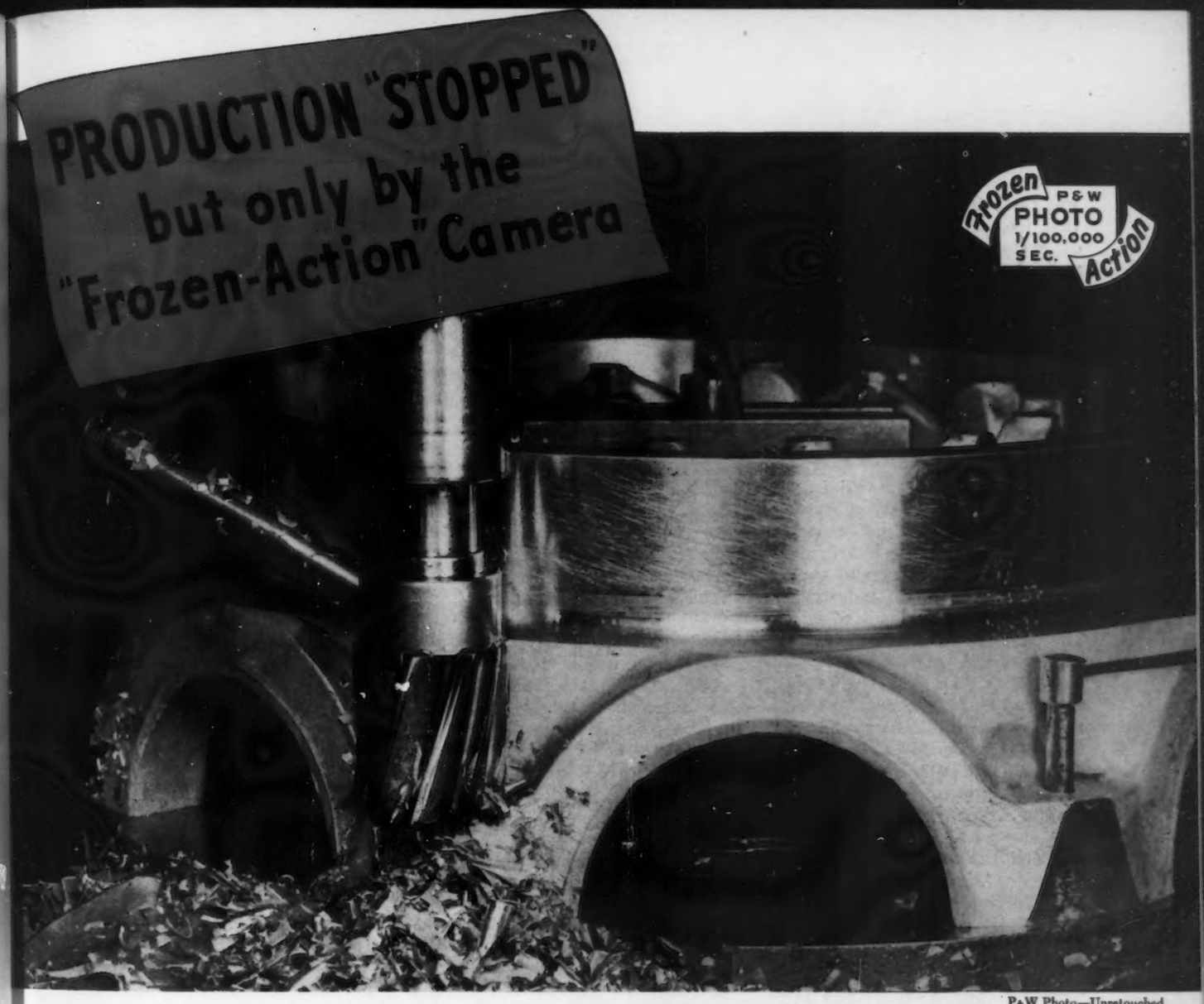
OTHER comparisons with automotive work include the fact that the number of inspectors has increased from about 1 per cent of the pay roll to approximately 10 per cent.

C. W. Avery, president, has announced that the firm is working on a new type of turret developed by General Electric for use on bombing planes and that the die shop is machining turrets for 28 and 30-ton tanks and for machine tools as a supplier to a machine tool company. It is also making frames for Ford jeeps and Dodge military vehicles and for Ford Motor Co. of Canada, and is manufacturing flame arresters for machine guns. Murray will soon begin production also on control surfaces for Curtiss for combat planes.

One of the latest assignments for this company is the production of a giant searchlight for Army anti-aircraft units, said to be capable of throwing a beam of light 15 miles, although no War Department figures on the intensity of such lights are available.

A slant on morale was picked up while walking down an aircraft assembly line last week. The workers had erected many signs urging speedier output, smashing of the Axis, etc. One shop artist had even assigned his fellow-workers to "spots" in a drawing of a fleet of bombers in the air. One notation said: "Art: He got riveted inside; he's got seniority."

The widely known George T. Christopher, an automotive manufacturing expert who went with Packard in 1934 as assistant vice-president of manufacturing, has just been elected president and general manager of Packard Motor Car Co. and given a post on the board. Christopher succeeds M. M. Gilman, who resigned recently because of ill health after an automobile accident. Christopher went into the Packard plant at the time when Packard was starting production of its 120 Series. The company then



P&W Photo—Unretouched

STANDING still? Not *this* milling cutter, mister! Twenty-four hours a day, *every* day, it's scooping big chips out of crankcases that are about to chase little yellow sons of Nippon right out of the sky. There are American aircraft engines being built — and *fast*, mister!

P&W cutting tools — reamers, taps, dies, end mills — are in there pitching, rapidly, *accurately* . . . consistently delivering *extra* cuts per grind.

The photo? No standstill pose that, but shot on the job at 1/100,000 sec., to show you just a sample of the hundreds of kinds of P&W precision tools now building American war strength in top-speed 3-shift production.

Don't spare the pressure. Your P&W tools can take it.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD • CONNECTICUT

was tackling its first mass production job, after years as a builder of custom-built cars, and Christopher was the man who helped make the conversion. He had started in the automobile business in 1917 as shop superintendent of the old Standard Manufacturing Co. at Terre Haute. Successively he was with Delco Remy, Oldsmobile, Pontiac and Buick before joining Packard.

DEEPLY immersed in war work, the Society of Automotive Engineers has just expanded its War Engineering Board, made up of topflight engineers of the automotive and aircraft industry, by the addition of six new members. They are L. R. Buckendale, vice-president and chief engineer, Timken-Detroit Axle Co.; Arthur Nutt, vice-president in charge of engineering, Wright Aeronautical Corp.; Don Berlin, aircraft engineer, General Motors Corp.; G. G. A. Rosen, director of research, Caterpillar Tractor Co.; Ralph R. Teetor, vice-president, Perfect Circle Co., and Earl H. Smith, executive engineer, Aircraft Engine Div., Packard Motor Car Co. Other members of the board now are J. C. Zeder, chairman, who is chief engineer of Chrysler Corp. and B. B. Bachman, vice-president and chief engineer, Autocar Co.; J. M. Crawford, chief engineer, Chevrolet Division, General Motors; R. E. Cole, vice-president of engineering, Studebaker Corp.; F. F. Kishline, chief engineer, Nash-Kelvinator Corp.; R. H. McCarroll, Ford Motor Co. and D. G. Roos, vice-president and chief engineer, Willys-Overland Motors, Inc.

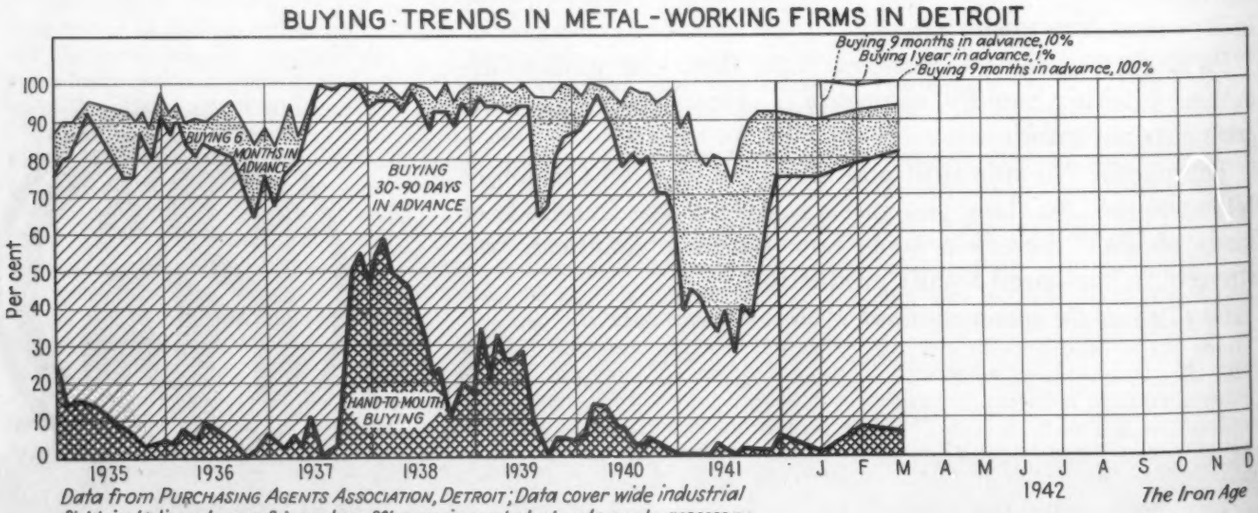
This group has been asked to undertake a great many projects to help War Department engineers, the War Production Board and the Automotive Council for War Production. Included in present projects is a systematic study of critical materials and motor vehicle equipment and armored vehicles for the Ordnance Department and the Quartermaster Corps. Recently it completed a survey of copper in replacement automobile parts and provided an engineering basis for the belief that nearly 40 per cent less copper will be required in the replacement parts manufactured for automobiles this year. Similar studies have been made of crude, reclaimed and synthetic rubber, and others are in progress on chromium, nickel, tungsten, tin and cork.

PREDICTED here in the last few days is the building of a bomber in America bigger than any of those built at present, with liquid-cooled engines instead of air-cooled engines. The prediction went on to say that the liquid-cooled engines would be bigger than those that are now being built. It could be guessed that the W-type Allison, which is approximately a hitching together of two of the 12-cylinder engines, might be the power plant in question. After all, Allison did exhibit this power plant at the World's Fair in New York several years ago. It was a handbuilt version, but experimental work has been continued on it.

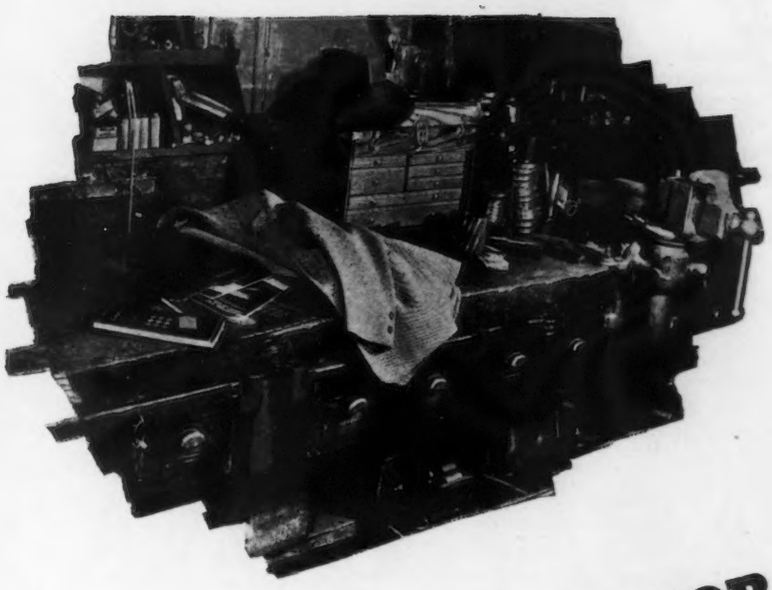
A preposterous request to President Roosevelt to send a personal representative to "investigate failure of the Dodge main plant management to convert to war production" was made last week by the Dodge local union No. 3 (UAW-CIO). The union contended that less than 25 per cent of the Dodge plant machinery and less than 10 per cent of the floor space is being used for war work and that a majority of 25,000 Dodge workers are now unemployed.

The request is preposterous because the Army, the Navy, the War Production Board and many other agencies of government are now entirely familiar with the Dodge set-up, as it is their duty to be. But in addition to that, is word from Chrysler itself that there are now war contracts which will fill the entire Dodge plant with more employees than it uses in normal times. The plant is being tooled as rapidly as machinery and tools can be delivered to the plant, the corporation declared. The union probably realizes that its howl cannot be specifically answered because exact production plans and figures are secret.

BUYING-TRENDS IN METAL-WORKING FIRMS IN DETROIT



Data from PURCHASING AGENTS ASSOCIATION, DETROIT; Data cover wide industrial field, including stove, refrigerator office equipment, steel, auto parts, accessory, auto plants, and all armament materials



MAN *all but* WORKING FOR YOU . . .

When you need him, he may have to take "the sleeper" to reach you—or he may be just a few miles away. • He is all but working for you, and it is easy to get him on the job. • He knows stainless and tool steels inside-out and has had experience that spells sudden death to production "bugs". In his briefcase is printed material to help you shoot output to new highs. • Get him working for *you* today by telling him about the tough problems *you* have to lick. • He is your Carpenter representative.

THE CARPENTER STEEL CO.

Reading, Pennsylvania

Washington . . .

• Priority school found necessary to teach WPB officials the intricacies of the system, but industrialists are forced to learn the hard way, with court room becoming their class room.

WASHINGTON—While WPB is trying to enjoin Carnegie-Illinois Steel Corp. and Jones & Laughlin Steel Corp. to prevent continuation of alleged priority violations, it is conducting a priority school to insure that WPB officials understand the system and keep abreast of current developments.

The necessity of the WPB school replete with professors, lectures and homework suggests the intricacies of the priority system. Consequently the question is raised whether an unschooled industrialist could possibly operate under the system with an E record. If WPB does not fully understand the priority system, it is hardly consistent for it to presume industry does.

Pertinent to this point is the policy officially announced last Thursday by WPB's Division of Industry Operations that all applications for priority assistance which do not specify a required delivery date will be returned hereafter to the applicant by WPB.

It is well known that steel producers have been confused over treatment they should give priority orders which bore no delivery date. They were uncertain whether they should start rolling at once, or whether they could delay production. It would be quite conceivable that the determining factor would depend on schedules in operation at the time such undated priority orders are received. For example, if they are rolling on a schedule where tonnage is of the type which happens to be called for by the priority order, they would as a matter of efficiency and volume output extend the schedule to cover such priority orders. On the contrary, if such priority orders covered material that was not being rolled, efficiency also would call for deferred rolling.

APPARENTLY, WPB has recognized this situation, and it may be that this new priority regulation is an acknowledgment that charges it has brought against steel companies for priority violations are not justified if they are based on undated orders. The resulting confusion naturally rested with the government itself, and not the steel producers.

The new regulation requires every applicant for priority assistance to specify in his application the latest date on which the items in connection with priority assistance is requested can be delivered to him to meet his contract obligations or production schedules.

"Nevertheless," WPB significantly pointed out, "many applicants, especially those submitting individual applications on PD-1-A forms, have been specifying 'immediately' or 'at once' instead of filling in a definite delivery date. Hereafter, no such applications will be considered until an exact delivery date has been filled in."

One of the lectures, titled "Acceptance of Defense and Other Rated Orders" dated Jan. 10 shows WPB appreciates the problem, internally, at least.

A pertinent part of the lecture is as follows:

"The general problem of requiring acceptance of defense and other rated orders is the least understood, and probably the most important aspect of the priorities procedure. The idea of being told which orders they must accept is apparently so novel and so revolutionary to business men that it is almost impossible for them to understand the fact that they no longer have freedom of choice when a rated order is offered, and that such an order must be accepted to the exclusion of ordinary civilian business.

"THE general rule that rated orders must be accepted is known, but the difficulties come in trying to recognize a defense order not accompanied by a certificate or a priority order. The frequent question asked by business men is, 'How do I know that is the kind of order that I must accept? How do I know that I must give it preferred treatment after I accept?; and, How much preferred treatment do I have to give it?; or, Do I have to treat it as A-10 or A-1 or A-2?'.

"In covering the field raised by the questions, there are two separate problems to consider. First, how to recognize a preference rated order; and second, how to tell a defense order which is not accompanied by a certificate or a priority order.

"Taking up the problem of recognizing rated orders first, a common question raised by manufacturers is, 'I have an order on my books and the fellow who sent it to me says it is an A-1-a rating. What do I do about it?' The invariable answer to that is, 'You don't have to do anything about it in that state of the record.' "

RATINGS are assigned only by certificates or orders. They are extended properly only by the method provided by the order for their extension. The mere statement by the original seller in ordering goods from his supplier that he has an A-1-a rating to fill does not in any case extend the rating, but WPB says that this is one of the most common misconceptions.

If ratings are not extended by the proper method, a manufacturer is not released from civil or criminal liability under the priority statutes. Conversely, a manufacturer is released if he obeys priority regulations or orders. Therefore, when an order is given an A-1-a treatment solely on the purchaser's statement that it is that kind of an order, there is no release from liability since the regulations have not been met. The most common method of extension is by en-

dorsement of purchase orders in the manner prescribed by the order assigning the rating.

The WPB "professor" further catechized his pupils:

"When a supplier is offered an order and is told 'This is a defense order,' what does he do? He must satisfy himself as any other reasonable man would satisfy himself when there is a question of fact raised. Here is a claim made that a particular order is a defense order.

"THE question he immediately asks himself is 'Is it within the definition?' and of course looks at the definition and says, 'Does it fulfill any of these terms? Has it an A-10 or higher rating specifically assigned?' and the answer in the doubtful case is usually 'no' or there wouldn't be any doubt about it. Again he asks, 'Is it from the Army, the Navy or the British or Lend-Lease?' The answer again, let's say is 'no.' And finally, 'Is it a subcontract or order for material to be physically incorporated in a defense order?' In the latter class of cases he should satisfy himself to the extent that he would satisfy himself in any other question of fact of that type. If he knows the firm and can rely on them, he can accept a letter from them saying, 'I have a specific A-1-a contract' or, 'I have a specific Army and Navy contract and I am buying this steel so that I may incorporate it in the delivery that I have to make,' as sufficient proof that such an order is a defense order. If he does not know them so well he may say, 'I want an affidavit from you or a certificate from you certifying to me that this is a defense order under one of the defined categories and stating the fact as to why it comes under the category.' To reiterate, that does not entitle him to give that order the preferred A-1-a treatment or whatever rating the prime contract bore, but it does require him then to treat it as a defense order, and he must accept it."

THE order, it was pointed out, should be treated as an A-10 order because Priorities Regulation No. 1 assigns an A-10 rating to all defense orders not otherwise rated.

International News Photo

NO $1-A-YEAR MEN: WPB chief, Donald Nelson, told member of the Truman Defense Committee that business men were refusing to come to Washington because of criticism and veiled allusions toward them, and it may be necessary to draft business men for war production work.

THE BULL OF THE WOODS — BY J. R. WILLIAMS

THE NEW OUTLOOK AND THE OLD LOOKOUT

Even if a mill is full of other orders, and there is no material not obligated by contract, a manufacturer must accept a defense order. He cannot turn it down unless all of the production is allocated to orders bearing higher or equal preference ratings. Or unless the order is not offered for material capable of being produced by the supplier at the producer's regularly established prices and terms of sale, or if the purchaser's credit standing would not satisfy in an ordinary case.

A mill could reject an order, too, if the delivery date which the order specifies would require the termination before completion of a production schedule already commenced, or if material completed or to be completed within a specified time must be used specifically for a defense order of a lower rating.

WPB officials went to school to learn the foregoing. But what of the men from industry who had no such advantage? Their lessons may be learned a bit more expensively in the nation's courts, and not in the cool recesses of a government building on the taxpayers' time.

15 Metals Included in Ban On Construction Materials

Washington

• • • **The Army and Navy** Munitions Board has included 15 metals in a list of 28 strategic materials critical in the manufacture. of munitions and has prohibited their use in Army-Navy construction work. However, in cases where the materials are deemed essential in a construction project of the supply arms and bureaus of the two services, consideration will be given by the Board to specific requests for such materials.

Eleven of the items included in the list are prohibited without exception. These include aluminum, cadmium, magnesium, manila, mercury, monel metal, nickel, silk, sisal, tung oil, and vanadium. Seven items in the list, namely, copper, cork, lead, rubber, iron, (steel), tin, and zinc, are permitted for some specified uses. For example, copper is permitted for 15 uses and prohibited for 61. In the case of rubber, six are permitted and 27 are prohibited. Fifty-eight uses for steel and iron are permitted and 44 prohibited. Tin is permitted for only four uses and zinc is permitted for ten uses. Manufactured articles, containing small amounts of critical material, for which no substitutes are commercially available, may be used in construction work if not specifically prohibited by the list.

Through special arrangements with WPB, the Army and Navy have agreed to comply with this list in lieu of submitting to the Board for approval a detailed list of materials prior to the start of a new construction project.

Frank H. Neely Named WPB Atlantic Director

Washington

• • • **WPB Chairman** Donald M. Nelson last Thursday announced the appointment of Frank H. Neely, former coordinator of the now defunct OPM Defense Contract Service as Atlanta Regional director.

The Atlanta office will be responsible for the administration of all WPB field offices in Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia.

WEST COAST . . .

• Priority compliance campaign might reach question of why some Coast ratings were issued in the first place . . . Big flood control jobs will require much steel, labor . . . Shops without war orders urged to release workers to war industries.

SAN FRANCISCO—If the War Production Board's priority compliance campaign ever reaches the Pacific Coast, investigation is likely to result in inquiry as to why WPB issued some of the ratings in the first place.

For instance, discussion is rife here as to why high class reinforced concrete residential projects in San Francisco and Los Angeles sponsored by the Metropolitan Life Insurance Co. have popped up with A-2 ratings while slum clearance housing planned by the Housing Authority either have been forced to redesign to eliminate steel, have been granted only A-4 ratings, or have been able to secure no action at all.

On page 14 of its "Report on 1941 Operations," Metropolitan says that the Los Angeles project "of 173 acres, centrally located, is in the La Brea section, one block from Wilshire Boulevard, (Editor's note: One of southern California's swankiest streets), and the San Francisco location consists of about 200 acres overlooking Lake Merced and the ocean and adjoining San Francisco State College. Each of these projects provides accommodation for about 2500 families, or about 10,000 or 11,000 persons. The buildings cover about 18 per cent of the land and consist of two-story fireproof apartments facing patios of beautifully designed gardens, with supervised playground facilities for the young children, swimming pools in one, and tennis courts and other recreation facilities in both."

Although the San Francisco site is in the country club district, about as far from any shipyard or defense activity as it could be and still remain in the city, it was classed by the WPB as "private defense housing" and assigned serial number 1587 under preference rating order P-55. The high class residences in the immediate neighborhood are all of frame and stucco construction, but delivery has already been made by Midwestern mills on a substantial portion of the several thousand tons of reinforcing steel "needed" for Metropolitan's project. Local mills, burdened with many higher rated orders, shied at supplying such a large quantity of steel on an A-2 rating, but operations of the Midwestern mill allowed it to fill the order, at least in part.

In contrast, the Housing Authority of the City and County of San Francisco has been unable to secure higher than an A-4 rating for its low rent projects in less savory sections of the City. The Housing Authority applied last January to the Defense Housing Coordinator in Washington hoping, through him, to have a rating granted for a low-rent project in Chinatown. Building of this project would not only mean new homes for workers, but would result in clearing some of the most thickly populated slums in America where 15,000 people are crowded into 20 blocks. Of the 3830 dwelling units now in this district, 3000 are without heating equipment and only 447 are rated "acceptable" by the Housing Authority. Swimming pools and tennis courts are not part of the new plan.

Contractors for Metropolitan's Los Angeles project of steel reinforced masonry construction have also been able to obtain promises of large tonnages of steel from an Eastern mill although public low rent projects have been redesigned to cut steel requirements to the bone.

Advance newspaper notices for the Metropolitan projects have stated that rents will be approximately $12.50 a room, possibly low enough to put them in the "defense" classification but still far from the lower brackets in the cities concerned.

Ratings for these projects were, according to local WPB offices, granted in Washington.

Apart from the feeling that big interests, well represented at the nerve center of activity can get steel when it is unobtainable locally, Coast steel consumers resent the continued failure of the WPB to decentralize authority, despite promises to do so. Over a month has passed since WPB announced it would establish 13 regional offices with as much authority as possible, but no director has been named yet for the San Francisco office. As long as Washington priority officials fight like mother eagles against any attempt to remove from the home nest the power to give ratings, the entire priority set-up is bound to be embarrassed by cases like that of the housing projects.

Seriously detracting from the Government's sincerity in an all-out war effort are projects like the two large flood control jobs on the Los Angeles River for which the United States Engineer has just opened bids. Between them, the two jobs will take about 5500 tons of reinforcing steel, structural steel, and steel bearing piles, to say nothing of enginering talent, labor, and equipment sorely needed elsewhere. When projects like this are pushed ahead, it is difficult to impress on industry the necessity for its starvation diet of steel.

Fortunately the Bureau of Reclamation has abandoned, despite Congressional pressure, projects planned purely for irrigation, and is continuing only those which will provide power. Efforts of the Bureau to obtain reinforcing steel for its power projects have been balked by the inability of Western mills to book orders on ratings no higher than A-1-j. Consequently awards have been made to Eastern mills at substantially higher cost because of freight.

WPB's Contract Distribution Branch has further recognized in its "sub-contracting" exhibit at San Francisco that many Coast metal-working shops will never fit

Courtesy The Jacobs Manufacturing Co., Hartford, Conn.

HARDEN 700 PER HOUR

with this new heat-treating process!

● Heat-treating outputs are being multiplied two-fold, three-fold and more by TOCCO—the new simplified electric induction heat-treating process! In fact, output of the drill chuck part shown above *was multiplied seven-fold!*

Where former methods required many man-hours, several operations and much scattered equipment, the TOCCO machine performs the complete hardening operation in *a matter of seconds*—with a push-button start and automatic precision control. *Doesn't require skilled labor.*

Where former methods heat-treated the whole part, TOCCO *localizes hardening* at the wearing surface—keeps the core tough—minimizes distortion, *eliminates straightening and rejects.*

Can be installed in assembly line because it is so cool, clean and compact (only 7 ft. x 5 ft., maximum).

For post-war production, too. Just change work fixture to adapt to peacetime products.

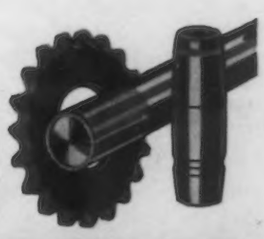
See how TOCCO can *speed up* and *improve* your output!

THE OHIO CRANKSHAFT COMPANY
Cleveland, Ohio

SPEEDY ELECTRIC HEAT IS GENERATED WITHIN THE SECTION TO BE HEAT-TREATED

TOCCO

World's Fastest, Most Accurate Heat-Treating Process



into the war production program if hostilities continue to doomsday. The exhibit was originated, like others at Kansas City and points east, to show items on which government procurement agencies and prime contractors sought bids. Actual operation has proved that only about 40 per cent of the items shown at any one time were available for immediate bids. The remainder was (and is) shown with the purpose of uncovering new potential sources of supply should future need arise or to show willingness to sub-contract with the knowledge that such a possibility was slight. Of the 40 per cent available for immediate bids, some metal items could be made in small sheet metal shops but at far higher cost than if specialized stamping facilities not available in this part of the country were used. Other items are suitable for drop forging on a production basis, but such shops are not as thick on the Coast as they profitably could be. Some work is available for machine shops, but tolerances are in most cases so close as to exclude the average small shop. As a group, foundries have been most successful among small business. Non-metallic items, mostly from the quartermaster corps, have no interest for the shops, but are abundant. About sixty contracts have been placed as a result of the exhibit, a good showing.

Rather than abandon shops which seemed to have no place in war production, Exhibit Manager R. W. Hawksley about two months ago assembled from a number of Coast jobbers goods which they normally obtained from Eastern manufacturers but for which the war made local sources of supply desirable. (THE IRON AGE, Feb. 19.) With rumors, as yet completely unconfirmed, that the railroads will soon be unable to handle any civilian freight whatsoever to the Coast, local suppliers are getting more and more inquiries. Prospective Coast manufacturers have not stepped up in large numbers offering to make these civilian jobbers' items, partly because, like Eastern makers, ability to obtain material is uncertain, and partly because they fear return of Eastern competition after the war.

One hope remained for the smaller, less specialized shops hoping to keep their labor forces together and continue operations on a reduced scale—substitute materials. When Hawksley looked for substitute materials to place on display he found only one that held even a glimmer of hope for the small metal shops—wood. Concrete, glass, and paper are on display, but not with much idea of interesting metal workers.

Wood rates some attention, not as finished lumber, but as composition pressed board of the Masonite type, made from lob lolly and mill scrap. This is susceptible to forming to such an extent, and uses enough metal working machinery, that one northern California shop proposes to use it to make fruit pickers' pails formerly made elsewhere from galvanized sheets. The same material is also under consideration for downspouts and gutters. It can hardly be called the white hope of little industry, however.

Other developments locally, outside the metal field, include raising a lower grade, higher cost domestic hemp in the Imperial Valley near the Mexican border; construction of a plant to make cordage from the fiber of the desert Yucca plant; and investigation into the possibility of using redwood bark, which sheds water and absorbs oil, for plumbers' oakum or mixture with wool in fabrics.

The Contract Distribution Branch now is frank about urging shops which can neither fit into the war picture or adjust their operations to close up and release their workers to war industry. "Pools," as a broad scale salvation for little business, practically have been buried, killed partly by a strong overdose of publicity. The obstacles which they have encountered were outlined in detail in this column months ago, just as the movement was getting underway, but the popular press and pseudo-business magazines raised and are still raising many false hopes.

Bethlehem's Shipbuilding Division at Los Angeles harbor was a target last week for charges before the NLRB by Local 9 of the CIO Marine & Shipbuilding Workers. The union says it is irked by the firing of 218 union workers during the past six weeks and their replacement by non-union men hired through Bethlehem's own employment office. Although it does not affect the charges, the union declares it is also piqued by Bethlehem's operating only one 10 hour shift each day.

Bethlehem, as the principal Naval shipbuilder on the Coast, will also be touched by the request of California's Congressman Anderson (Rep.) that the House Naval Affairs Committee investigate "the entire Naval ship construction and procurement program on the Pacific Coast."

North central Washington iron properties of Washington Nickel Mining and Alloys Corp. have been purchased by American Alloy Steel Corp. with reported prospect of immediate development.

Another Pacific Northwest ferrosilicon plant, in addition to that planned by Ohio Ferro-Alloys Corp. just east of Washington's Cascade Mountains, is being discussed by other interests at Lewiston, Idaho. Both plants would supply Reynolds Metals' huge magnesium reduction plant to be built in the Spokane vicinity.

Creaking government machinery has finally resulted in appropriation of $15,000 to build a 7½ mile road to a 2000 ton chromite deposit near Grant's Pass, Oregon, one of many such deposits which could be opened up were roads available.

GENERAL "MUD" TAKES OVER: On the German eastern front, this German truck is being towed out of the mud, according to the caption on this German photo. Spring thaws are not helping the mobile units of either army.

Wide World Photo

Here's what you Get...

When You Order a PORTER Fireless

Porter Fireless Steam Locomotives are designed and built to give you something extra for every dollar you invest in them. In addition to the features listed, you get quiet operation, cleanliness and safety.

If steam is available in your plant, a Porter Fireless can save up to 50% in haulage and switching costs. They are available in direct or geared types, in sizes from 10 to 100 tons. Write for complete information.

ONLY PORTER BUILDS A COMPLETE LINE OF LOCOMOTIVES FOR INDUSTRY

DEPENDABLE DELIVERY

You can count on the delivery promise for a Porter Fireless, since no critical materials such as diesel engines, electric motors, etc., are required.

SIMPLE OPERATION

There are no complex controls in a Porter Fireless. New, unskilled employees learn to operate and service the locomotives quickly. Porter Fireless locomotives are rugged and cannot be damaged by inexperienced operators.

LOW OPERATING AND MAINTENANCE COSTS

A Porter Fireless uses low cost steam produced in stationary boilers, for fuel. Charging can be done during idle periods. No night or week-end attendance is necessary. Fewer working parts mean fewer repairs. There is no boiler or firebox and reservoir never needs replacement.

LOW INITIAL COST

A Porter Fireless costs less than most other types of locomotives. It does not require diesel, electric or other motors. There is nothing to make initial cost high.

LONG LIFE

The first Porter Fireless was placed in service in 1914, and is still working efficiently.

PORTER "better built" locomotives

H. K. PORTER COMPANY, INC.
PITTSBURGH • PENNSYLVANIA

Fatigue Cracks

BY A. H. DIX

Eyes on the Ball

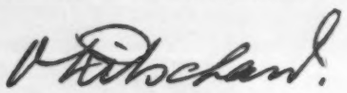
• • • "One Day Nearer Victory" is how the Dura Co., Toledo, ends its letters. Bill (Armco) McFee signs off with "Yours for Victory," and your favorite family journal's Advertising Department uses the familiar . . . — as its epistolary leave-taking. Washington calls for more parades, and an increasing number of towns are sending men off to camp with a fitting flourish instead of letting them depart unsung in the cold hours of the morning.

Each of these is a war advertisement. For a time we thought that a national war fervor was something you automatically acquired with the declaration of war, like grace with baptism. But we were wrong. Now we know it is a state of mind created by repeated impressions. It is built up bit by bit, just as you slowly carve in the public consciousness a place for any new product or idea.

Therefore, a bow to Dura, Bill McFee, our own Advertising Department and others who neglect no opportunity to remind us of the big job before us.

Help

• • • A note that just came in, without company connection or address, bears this signature:



We can't decipher it. If the owner of it is one of this page's loyal army of eighteen readers and if he will send us his address we will mail him what he asks for.

Pipe Dream

• • • Don James of the brains department picked this up on his market calls. We vouch for its doubtfulness:

> *Washington wires a steel company to ship several hundred tons of pipe to the British, with British threads. Steel company wires "Have pipe for British but it has American threads." Washington answers "Ship pipe now. Ship British threads later."*

He Was So Young

• • • Another complaint concerns the caustic comment a member of the brains department wrote across a photograph showing an English industrial executive dictating letters while riding in a plane. Our man, who may have a touch of adiophoria, wrote, "No man has to be *this* busy." To which John Paddon, Washington, replies acidly:

> There is no reason to assume brains should always be coupled with imagination. Let's pretend the spectacled gentleman in the photograph is Mr. Binks. One morning the head man says, "Binks, the Ministry is sending a man over late this afternoon for exact information on the present production of our plant in Scotland, together with an estimate of steel needed for an immediate expansion to double output. They must have the data ready for a meeting tomorrow morning."
>
> "It is now 9 A. M. There's a plane waiting at Heston to run you up to the Scottish works. Take Miss Blank along and dictate the stuff on the way back, and be back not later than four today. Sorry to chuck this on you so unexpectedly but you're the planning man and it's up to you."
>
> It doesn't take much imagination. I was working in England in '38 and '39.

And the anonymous Deac, who has seen everything and done everything, chirps:

> Nuts to your stooge who says no man is busy enough to dictate in an airplane. When I was secretary, in 1915, to (censored), the founder of (censored), I could and did take 100 words a minute all the way from New York to Boston (and return).
>
> The kind of men who work in shops are exhausted in 50 hours; the kind who found businesses and give jobs to clock-watchers and train catchers like you never get tired. If we had more men like (censored) and me, this war would be over.

Very likely Deac's human dynamo took four hours for lunch, called endless conferences that he could sleep through with his eyes open and invented many other devices for stretching an eight-hour day to sixteen half hours. He was probably always careful to rush furiously from one rest period to another, and doubtless had mastered the trick of freezing his facade into a frown of concentration even while the works in back were ticking at adagio. Thus he deceived his adoring, adolescent amanuensis, who should have learned by this time that those who get the most done seem never to be hurried.

Farragut or Dewey

> A recent advertisement credits Farragut with giving the famous command "Damn the torpedoes! Go ahead!" at Mobile Bay on Aug. 5, 1864. I have an idea that it was really voiced by Dewey at Manila Bay some 34 years later. I looked it up in the Britannica, and while I find no quotations by Dewey or Farragut, I find that in 1864 the so-called torpedo was of the "spar-type"—an explosive on the end of a spar and propelled by some enterprising gent in a small craft, and detonated by ramming against its objective. Also I find the Whitehead torpedo was not invented until *after* the Civil War.
>
> The advertisement is excellent regardless who uttered the command. But did Farragut really say it, or was it Dewey?
>
> —*D. C. Warren*

The only one we remember is Commodore Perry's "Don't fire until you see the whites of their eyes." And it probably doesn't matter much, as the best of the historic sayings are post facto inventions. Brilliant remarks are seldom coined on the spur of the moment; they are thought up painfully later on and are then back-dated.

Quick as a Wink—Quicker

• • • We said recently that a stop-action photograph of a gear grinding operation, as shown in a recent Pratt & Whitney ad, was taken with a *lens speed* of .00001 sec. This is not so. Ed (P&W) Shultz writes:

> No lens shutter was ever made to work that fast. This is a light exposure job. The speed of the *flash* was .00001 sec.

Our hobby is guppies.

They Call a Spade . . .

• • • The number and variety of bureaus listed in the new, fat Congressional Directory awes us. Our favorite is named the "Alley Dwelling Authority for the District of Columbia." It is a slum reclamation project, and strikes us as a happy high in cognominal candor.

Sign-Off

• • • Your Southern California eyes and ears, R. Raymond Kay, says this sign hangs in a Los Angeles restaurant:

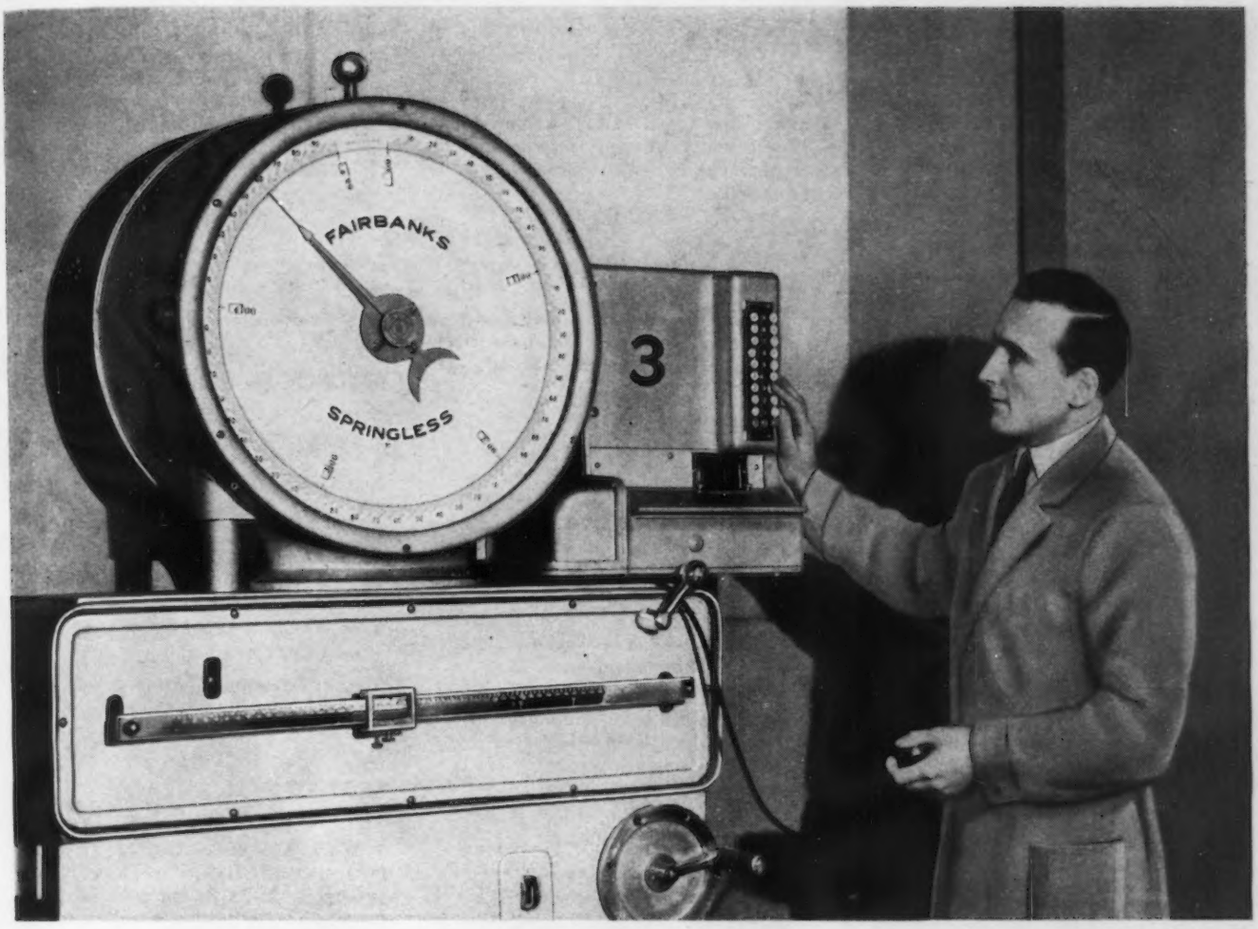
> **During blackout, business as usual.**
> **In case of direct hit, we close immediately.**

Puzzle

Last week's pool was filled in 4 8/13 hours.

James T. Gordon telephones that this one was given to a high school sophomore class and only one student solved it. Since then he has tried it on dozens of adults and no one has solved it in the time limit of 45 seconds. Pencil and paper not allowed:

A fish weighs 4 lb. plus 1/4th of its weight. What is its weight?



THIS SCALE READS ITSELF

... Prints the Weight, Too, at the Touch of a Button

Yes, this modern Fairbanks Scale *reads itself* with unvarying accuracy, and *prints* the correct weight on ticket or tape or both. It speeds production by weighing faster. It prevents the great losses which result from repeated small errors. It replaces scrawled, hard-to-read figures with clearly printed records of weights and related data.

And, important as those advantages can be in your plant, they result from but one of many plus values available in today's Fairbanks Scales. For the applications of these scales are vastly extended ... not only by automatic printing devices, but also by ingenious uses of photo-electric cells, limit switches, and other electric control mechanisms.

LET US HELP YOU SPEED PRODUCTION

We want to do everything within our power to help speed American production. Possibly our scale engineers could suggest new and more efficient uses of your present scales, or modernizations which would attune them better to today's tempo. Consultation involves no cost or obligation. Write Fairbanks, Morse & Co., Dept. D38, 600 S. Michigan Ave., Chicago. Branches and service stations throughout the United States and Canada.

FAIRBANKS·MORSE SCALES

DIESEL ENGINES ELECTRICAL MACHINERY MAGNETOS RAILROAD EQUIPMENT WASHERS-IRONERS STOKERS
PUMPS MOTORS FAIRBANKS SCALES WATER SYSTEMS FARM EQUIPMENT AIR CONDITIONERS

Dear Editor:

CONTROLLED ATMOSPHERES

Sir:

I have urgent need for a collection of four articles which appeared in IRON AGE from November 21, 1940, to December 12, 1940. The title was "Industrial Controlled Atmospheres" by Norbert K. Koebel. Could you possibly furnish me with a reprint?

MARTIN WM. OFFINGER
Stevens Institute of Technology
Hoboken, New Jersey

• These articles were published in book form by the Lindberg Engineering Co., 2450 W. Hubbard St., Chicago. We believe the price is $1.—Ed.

PRIORITIES

Sir:

Your magazine, especially the priority section, is well appreciated by our firm. We are encountering many different types of preference rating orders, some of which we have to extend to our suppliers. Do you have any further information regarding the various preference orders and their proper form of extension? We are in need of a guide or booklet to help us in further extending priorities received from our customers.

FRANK HOLLEY, JR.
Continental Rubber Works
Erie, Pa.

• See the Priority Guide.—Ed.

BLAST FURNACE AIR HEATING

Sir:

We thoroughly enjoy all articles by Mr. J. H. Van Deventer, especially his article "Can You Save 30 Seconds a Day?"

We are also keenly interested in your article "Blast Furnace Air Heating," which starts in April 16 issue of THE IRON AGE. We would appreciate you advising us if it would be possible for us to receive six reprints of this article.

H. C. BENNETT
Sales Manager
Mosher Steel Company
Dallas, Texas

METAL SPRAYING

Sir:

May we have your permission to make reprints of the editorial, "Salvage," in your Feb. 5 issue, by J. H. Van Deventer, naturally giving credit to IRON AGE?

R. BURR
Metallizing Company of America
Chicago, Illinois

• Granted.—Ed.

LIGHT ALLOY ARMOR PLATE

Sir:

In the March 19 issue, you have an article on Light Alloy Armor Plate. Would you kindly advise whether this is obtainable in America and if so, from whom.

G. W. VENNELS
Dist. Manager
Railway & Power Eng. Corp., Ltd.
Vancouver, B. C.

• We don't think it is made on this continent. The article details entirely with experiments made abroad.—Ed.

PALM OIL SUBSTITUTE

Sir:

Your March 26 issue has an article on new tinning oils, quoting report of the Tin Research Institute. Please advise where I can get a copy of this report, especially the material which is superior to Palm Oil.

J. J. LANDIG
The Delaware, Lackawanna & Western Railroad Co.
Scranton, Pa.

• Write to Battelle Memorial Institute, Columbus, Ohio.—Ed.

WOOD FOR STEEL

Sir:

We are wondering whether you might have a list of steel items which are now being converted to wood. If you have any information on this it would be very much appreciated.

S. A. SNYDER
Snyder's Limited
Waterloo, Ont.

• We have no list. The conversions we know or are few—more railroad cars of wood, more wood structures in certain types of aircraft, some novelties. But as the war progresses the shift to wood doubtless will grow. —Ed.

RUBBER DIES

Sir:

The writer has been informed that you publish a book "Manual on Rubber Dies." Will you kindly give me some information about this book, price, etc. Or better yet, will you send me a copy on approval?

I am fairly well acquainted with the conventional types of dies for mechanical presses, but am now engaged in an airplane factory where many stampings will be made on hydraulic presses with rubber pads, etc.

CHAS. R. ENGEL
Linden, N. J.

• We have published no book on rubber dies, but the two-part series, "Job Lot Aircraft Stampings, in the Oct. 19 and Oct. 26, 1939, issue of THE IRON AGE was among the first comprehensive descriptions of the rubber die process. Watch coming issues for some excellent new information on the subject.—Ed.

STANDARD STEELS

Sir:

Will you please send twelve reprints of this article "Correlated SAE and AISI Revised Standard Steels" appearing in the April 9 issue of THE IRON AGE, if such reprints are available.

C. B. TEMPLETON
Asst. to President
Allegheny Ludlum Steel Corp.
Pittsburgh, Pa.

• Reprints are available.—Ed.

HYDROGEN EMBRITTLEMENT

Sir:

In the November 27 issue, you had an article entitled "Hydrogen Embrittlement" by H. J. Noble. I should like very much if you could let me have several copies.

C. F. PEARCE
Manager
Aero Engine Division
The Standard Machine Works
Winnipeg, Canada

• Heavy demand for this article necessitated reprinting. Copies are available.—Ed.

SOFT STEEL FOR BRASS

Sir:

We have been informed from several sources that there is a type of soft steel that is being used to replace brass and copper on small manufactured articles. We would appreciate your checking this matter and advising us the names of several suppliers of this material and also the name by which it is called.

ROBERT P. CRICCO
President
Unique Metal Novelty Mfg. Co., Inc.
North Bergen, N. J.

• Practically any steel company makes material of this type, but, of course, priorities prevail and in most instances the material is available only for war work.—Ed.

HEAT TREATING CALCULATOR

Please send us a Heat Treating Calculator, as mentioned in the Apr. 16 issue. We understand this is published by Peter A. Frasse & Co.

KENTON W. BUSHEY
Armstrong Cork Co.,
24th St. & Allegheny River,
Pittsburgh, Pa.

• Will Peter A. Frasse & Co., 17 Grand St., New York City, please oblige?—Ed.

PRICE MANUAL

Please send us three copies of your Price Manual, at 25c. per copy.

CHAS. L. HEATER,
Vice President
American Steel Foundries,
Chicago

This Industrial Week . . .

° ° °

Judging from recent developments in the metal industries, this nation's foremost war production front, the stage is set for new and higher levels of activity which will prove to be among the war's decisive factors.

Large sections of the aircraft industry are beginning to carry out important maneuvers on new models and new materials which eventually are likely to form a startling chapter in aviation history. At the some time the industry is expanding rapidly. The first plant building complete aircraft in the Chicago area will soon be in construction, according to information given THE IRON AGE and subsequently censored and confirmed at Washington. The plant will be operated by Douglas Aircraft Co. and built with government funds. It will produce a large type of plane.

Japan's War Plants Highly Concentrated

When the master plan for building U. S. aircraft plants is carried out fully, concentrations of aircraft factories in this country will be hard for bombing planes to find. Japan, without our vast spaces, must concentrate its industries. (See the following pages for the map, "Japan's War Plants," for locations of that country's principal war industries. Keep this map to understand United Nations air raids on Japan.)

In the background, metallurgists are quietly stepping up tensile strengths of aircraft materials to points which 18 months ago seemed impossible of attainment. Genuine progress is being made toward adjusting specifications, which will benefit many metalworking plants hitherto unable to serve the nation to the fullest extent.

And output of some raw materials, like magnesium, has progressed so significantly that serious consideration is being given the necessity for finding more primary fabricators, preferably through conversion of existing facilities.

As to the steel industry, thoughts in governmental circles recently have been directed toward more expansion, 110 million tons of ingots or what have you, but such a trend is quite likely to be forestalled by the industry's constantly improved performance and by the difficulties in obtaining enough scrap and pig iron to support any very large expansion.

Steel ingot production during the coming week, according to estimates by THE IRON AGE, will reach an all-time high, with operations scheduled at 100 per cent of the rated capacity of the nation. While 100 per cent operations were reported in May, June and July, 1941, capacity figures for the industry have since been revised upward, and the previous reports of 100 per cent are only equal to about 98.5 per cent as calculated under the present rated capacity.

The freer movement of scrap is the main factor in the increase in production during the past two weeks. Some mills are beginning to lay up modest reserve stocks, as much as two weeks in one case at St. Louis. Another mill reported that its facilities are taxed to handle the scrap inflow. This, however, is an exceptional case.

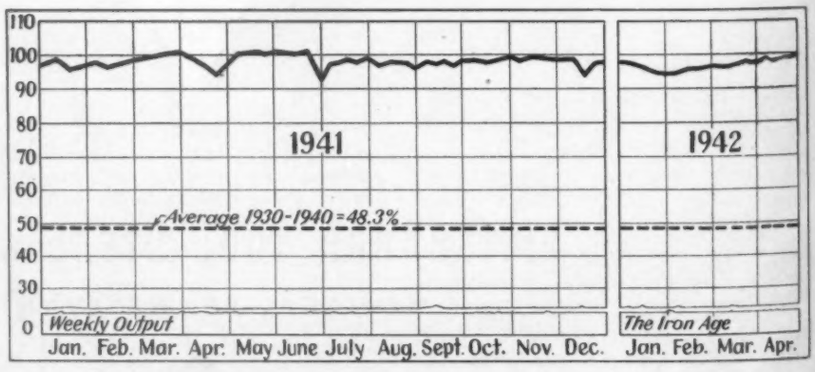
Six Districts Show Higher Steel Rate

Steel production for the coming week shows six districts operating at a rate higher than last week, with Pittsburgh up 1 point to 100 per cent, Chicago up 1 point to 105 per cent, Philadelphia up 1 point to 92 per cent, Cleveland up 4½ points to 99 per cent, Detroit up 3 points to 105 per cent, and St. Louis up 4 points to 107 per cent. The only area that reported operations down this week was the eastern district, with a decrease from 112 to 98.5 per cent.

The remaining districts reported no change in their operating rates, with Youngstown at 101 per cent, Buffalo at 106.5 per cent,

Steel Ingot Production—Per Cent of Capacity

(Open Hearth, Bessemer and Electric Ingots)



Steel Ingot Production, by Districts—Per Cent of Capacity

	Pittsburgh	Chicago	Youngstown	Philadelphia	Cleveland	Buffalo	Wheeling	South	Detroit	South Ohio	West	St. Louis	East	Aggregate
Week of April 21	99.0	104.5	101.0	91.0	94.5	106.5	83.0	95.0	102.0	104.0	97.0	103.0	112.0	99.0
Week of April 28	100.0	105.0	101.0	92.0	99.0	106.5	83.0	95.0	105.0	104.0	97.0	107.0	98.5	100.0

Wheeling at 83 per cent, the South at 95 per cent, the Southern Ohio river area at 104 per cent, and the Western district at 97 per cent.

Already turning out more steel for war production than was believed possible a few months ago, the industry can be expected to establish more new records from now on. The stepping up of priority ratings is assisting finished steel production; new pig iron and raw steel facilities are aiding the industry, recent WPB interpretations and rulings have been helpful, and soon practically all "nonessential" civilian items of steel will be banned completely. A list of 350 to 400 articles has been made up. The total saving of steel will be large, for such a product as bobby pins alone, banned this week, consumed around 4000 tons of alloy steel per year.

Further Plate Increase Sought

Of course, difficult spots probably cannot be eliminated entirely. Some steel products undoubtedly will become tighter than they now are. The all-out drive to produce ships and more ships was brought home to operators of wide strip mills last week when practically all of these units were asked to step up plate tonnage sharply, a move which is a squeeze play on sheets from these wide mills. At the same time some sheet mills were asked to furnish complete May schedules on production, likely a forerunner of drastic action which also can be expected to confront hot rolled bar divisions eventually.

Increased Lend-Lease activity, a stepup in munitions steel requirements, and the increasing shipbuilding program have caused an upward surge since the start of the month.

Lend-Lease activity in particular ought to worry the dictators, if they only knew the full facts. Shipments for Russia, where Hitler this week predicted that the "war decision will fall," are increasing substantially and involve tremendous tonnages of steel.

In order to facilitate the shipment of goods from this country for export, much effort is being directed to prevent the clogging of freight at port cities. Controls are not only being put on commercial shipments, but upon certain military shipments as well.

Of all of today's problems, however, questions surrounding labor and wages continue the most bothersome to the metal-working industries. The new Roosevelt "anti-inflation" plan is being viewed as hardly an adequate cure for wage problems which exist. In some plants hourly workers are now earning more than supervisory and lower bracket executives. There are marked inequalities in pay between comparable industries.

Strikes Still Hamper Output

Strikes and slowdowns continue to interfere seriously with war production. In one large midwestern city a large aluminum fabricating plant is reported still contending with slowdowns; another plant can't fire union members turning out only 30 per cent of the amount of work produced by fellow employees; officials of another firm grimly watch workers waste a half hour in each daliy eight-hour shift, and so on. The effect of such incidents is even felt in neighboring plants.

The War Labor Board's majority decision of last Saturday in the Federal Shipbuilding & Drydock case ordering a maintenance of membership for the CIO is definitely held to be a fixed pattern as a labor policy and consequently is expected to be invoked in the pending "Little Steel" case.

Further, close observers of the War Labor Board express the belief they would not be surprised to see it recommend a wage increase in steel. SWOC has asked for a $1 a day increase, but a rather common speculation is that it may get 40c. per day or 5c. per hr.

While such a decision evidently would be permissible in line with the President's latest message, nevertheless the action would emphasize the difficulty in holding down prices while not controlling wages by legislation.

In some quarters, this week's price actions are seen as merely a stopgap in view of the wide open wage problem. At any rate, numerous adjustments in prices are apt to be necessary. As far as the metal-working industry is concerned, most major items already are under price control.

Stamps Out For Machine Tools

In the near future, there may be an important change in the steel warehouse price ceiling order, and OPA is said to be in the process of setting up a price ceiling for the fabricated concrete bar industry. Curiously, sellers of steel mill products have been bothered by several instances of price concessions this year.

The trend toward more and more allocations and less dependence upon priorities continues. WPB's order that no nonrated steel tonnage may be shipped after May 15 is in most instances a formality since practically all steel companies shipments so far this month have been at or above 99 per cent rated tonnage.

However, in the machine tool industry, confusion surrounds the allocation question. Apparently the War Production Board decided to do away with its "stamp" allocation plan, after considering its practicality for only a few days. This is the second time that definite plans for allocating machine tools have been abandoned. However, the industry takes a favorable view of the whole matter since it appears WPB is giving the entire situation very careful consideration.

AFL Official Would Also Freeze Wages

Cleveland

• • • John H. Rohrich, vice-president, the Teamsters' Joint Council, went on record here during a meeting of the International Association of Machinists, as being in favor of freezing of wages, in addition to profits and prices. Mr. Rohrich stated that labor would be "better off," if this were done, because he believed it could not get wage increases often enough, or great enough, to compete with rising costs. He emphasized that his stand was purely a personal opinion, notwithstanding the fact that it is a direct deviation from the expressed policies of the A. F. of L. and CIO.

FROM AN ORIGINAL DRAWING BY ORISON MACPHERSON

BLAST FURNACE MEN SPEED IRON PRODUCTION FOR MORE FIGHTING STEELS

With the precision of a gun crew in action, a team of skilled men jumps to the task of replacing a burned-out tuyere in their blast furnace. Tools, parts and materials always ready, they snap into action. In a matter of minutes the job is done. The blower opens the wind valve. With a rush and roar the hot blast is on again. Iron for war steel keeps on smelting.

It is this work-coordination of men and management that sets today's record-breaking production pace at J&L.

No waste motions here, no wasted minutes, for these men at the blast furnaces and throughout the works are determined that fighting steels and more fighting steels shall be made *today*.

JONES & LAUGHLIN STEEL CORPORATION

AMERICAN IRON AND STEEL WORKS • PITTSBURGH, PENNSYLVANIA

PARTNER TO INDUSTRY IN WAR PRODUCTION

J&L STEEL

News of Industry

Kyushu and Honshu Islands Focal Points of Japan Industry

• • • **Of the four** principal islands that make up Japan, Honshu and Kyushu carry on by far the bulk of the industrial activity of the nation. Kyushu, with such cities as Moji, Nagasaki, Fukuoka, Kokura, and others, is a dominant heavy industry section, with shipbuilding, iron and steel production, aircraft construction, coal and metal mining, naval ordnance depots, coaling ports, and such making up its activities.

On Honshu, the center island of the shoestring land bridge, are the cities of Tokyo, Kobe, Kyoto, Yokohoma, Nagoya, Shimonoseki, Niigata, and others, that likewise are industrial centers. In these cities are steel plants, shipyards, aircraft plants, machine tool builders, and the majority of the nonferrous metal smelters.

The island of Shihohu is not so much an industrial center as it is a mining district. Many metal mines dot the island, and nearly all domestically produced copper in Japan comes from this area.

To the north is the island of Hokkaido, with Hakodate, Muroran, and Otaru the large cities.

o o o

By T. E. LLOYD

o o o

With the exception of some minor industrial activity in these cities, the great production item of this island is coal, from the central part. While this coal, on the whole, is not good coking variety such as may be used in steel production, it is believed that with Nippon facing possible shortages, the vast quantities produced in this region will be directed into heavy industry in spite of its low quality.

Japanese heavy industry, largely government controlled, is for the most part concentrated in Tokyo, Kobe, Osaka, Yokohama, Nagoya, Kyoto, Moji, and Shimenoseki. At these points, it is believed, 85 per cent of the finished material vitally required to keep an army in the field is manufactured.

Raw materials used by Japan are largely imported. Iron ore is brought in from Malaya and Manchuria. Korea and occupied China also contribute to the ore supply, as does the unfederated State of Johore, which is Japanese controlled.

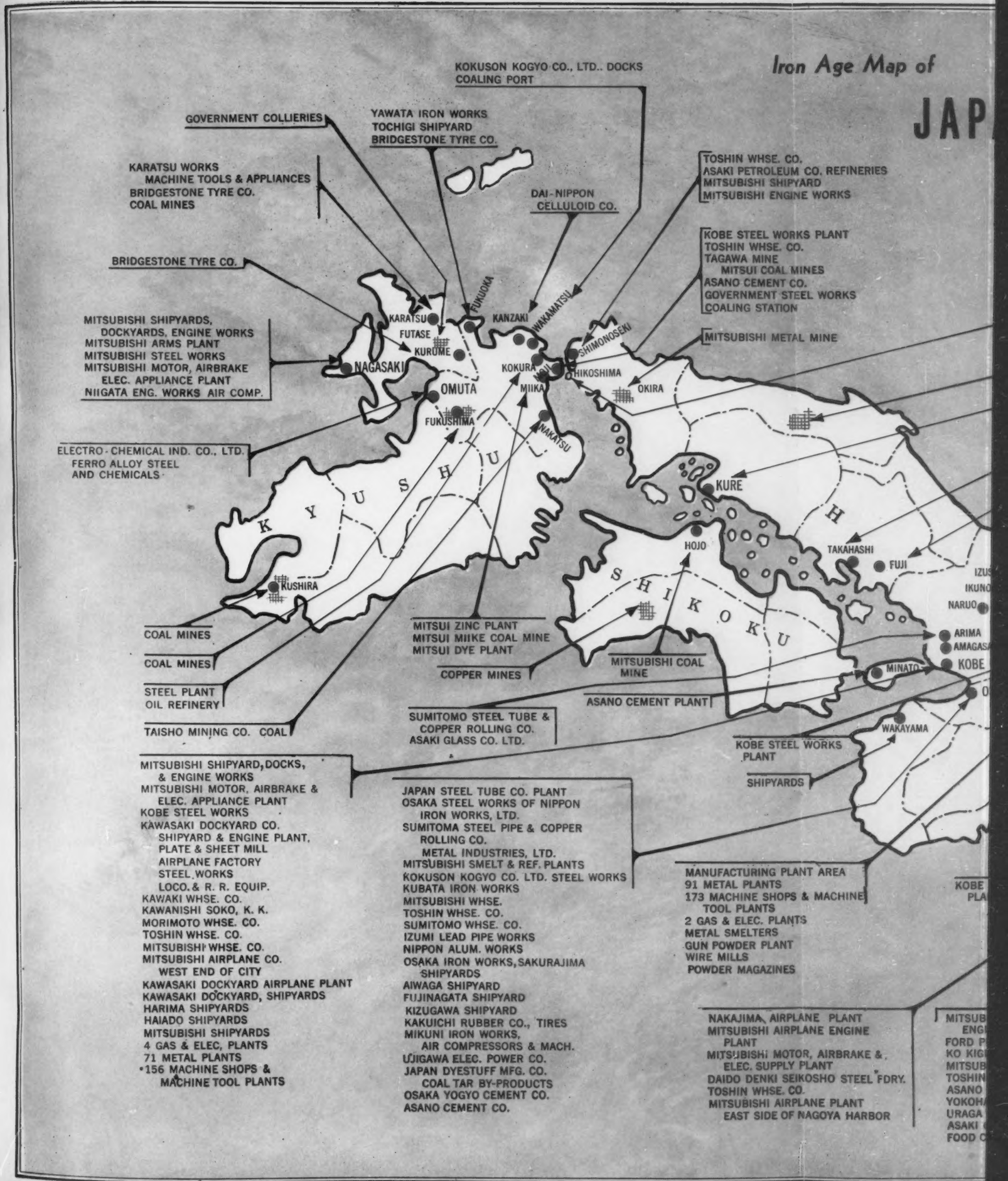
(See following pages for large-scale map showing locations of the principal plants in Japans munitions industry)

Coal supplies in Japan are quite sufficient for fuel and power, but reserves of coking coal are limited. Imported coking coal comes largely from the Kaiping mines in North China, formerly operated by the Kailan Mining Administration, an Anglo-Belgian interest. Coal used for fuel and power, in large part comes from Hokkaido island. Here the Hokkaido Colliery and Steamship Co., the Mitsui, and the

OSAKA: This Japanese city has become very important as an industrial center during the past 10 years, replacing to a great extent the industry that was previously centered around Yokohama. For map of Tokio, turn page.

Photos by Wide World and International

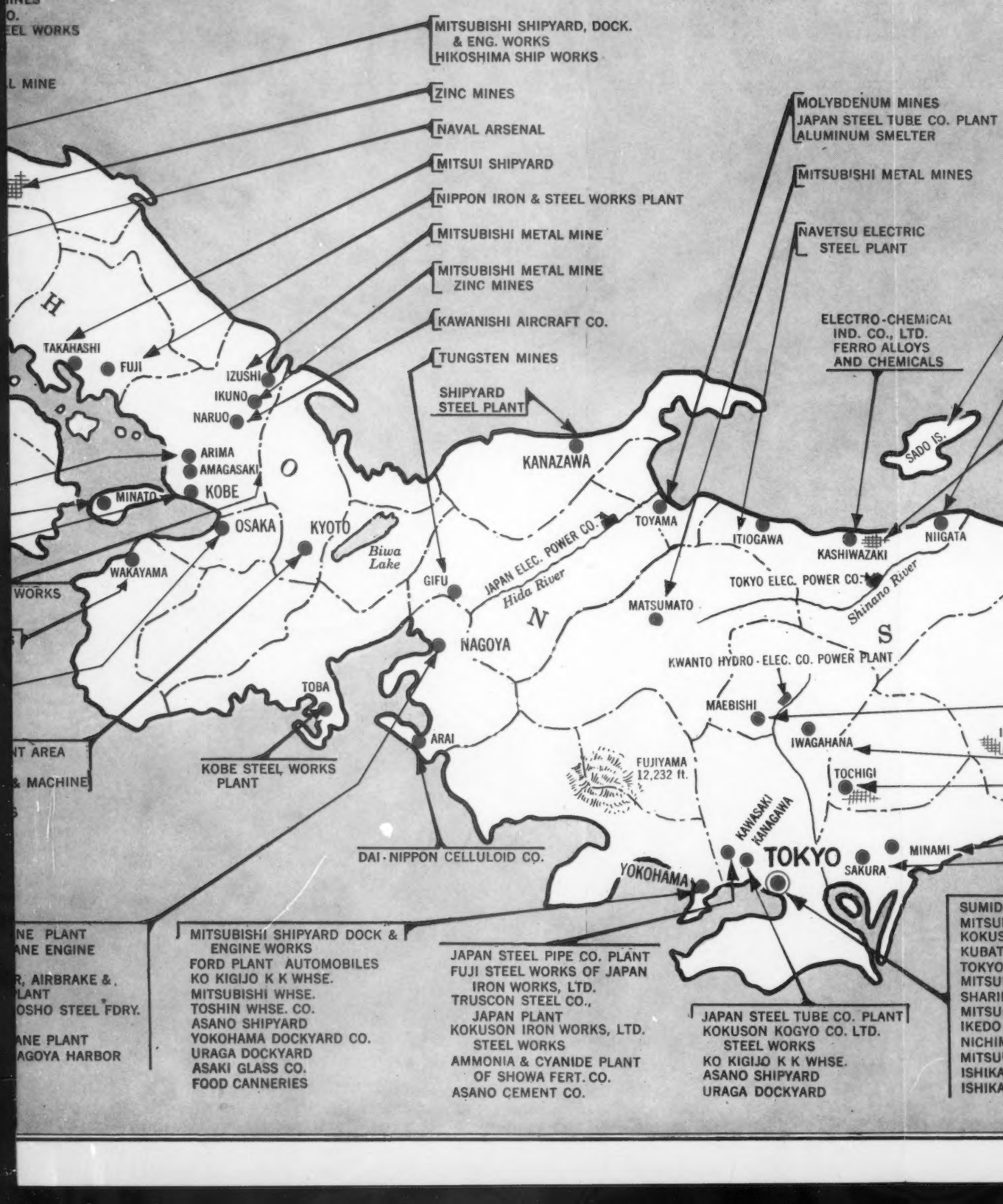

MILITARY COLLEGE
POWDER MAGAZINE
PARADE GROUNDS
FACTORIES
MILITARY ARSENAL
BRITISH EMBASSY
MILITARY ACADEMY
BARRACKS
WAR DEPT.
IMPERIAL BARRACKS
OCHANOMIZU STATION
FOREIGN OFFICE
U. S. EMBASSY
IMPERIAL PALACE
FACTORIES
DIET (Parliament)
NAVAL DEPT.
ASAKUSA
(World's Worst Slum Area—
2,000 People to Acre)
NAVAL ARSENAL
POLICE HDRS.
IMPERIAL HOTEL
CENTRAL TOKIO STATION
CITY HALL
TO YOKOHAMA (18 Mi.)
SHIMBASHI STATION
BANK OF JAPAN
BUSINESS SECTION
RICE STORES
R.R. YARDS
BUSINESS SECTION
GINZA (TOKIO'S BROADWAY)
NAVAL ACADEMY
NIHONBASHI (Crowded Market Section)
RIVER
NAVAL REPAIR BASE
SUMIDA
FACTORIES
TOKIO BAY
SHINAGAWA BATTERIES
FUKAGAWA


Iron Age Map of
JAP
KOKUSON KOGYO CO., LTD.. DOCKS
COALING PORT
GOVERNMENT COLLIERIES
YAWATA IRON WORKS
TOCHIGI SHIPYARD
BRIDGESTONE TYRE CO.
KARATSU WORKS
MACHINE TOOLS & APPLIANCES
BRIDGESTONE TYRE CO.
COAL MINES
DAI-NIPPON
CELLULOID CO.
TOSHIN WHSE. CO.
ASAKI PETROLEUM CO. REFINERIES
MITSUBISHI SHIPYARD
MITSUBISHI ENGINE WORKS
KOBE STEEL WORKS PLANT
TOSHIN WHSE. CO.
TAGAWA MINE
MITSUI COAL MINES
ASANO CEMENT CO.
GOVERNMENT STEEL WORKS
COALING STATION
BRIDGESTONE TYRE CO.
MITSUBISHI METAL MINE
MITSUBISHI SHIPYARDS,
DOCKYARDS, ENGINE WORKS
MITSUBISHI ARMS PLANT
MITSUBISHI STEEL WORKS
MITSUBISHI MOTOR, AIRBRAKE
ELEC. APPLIANCE PLANT
NIIGATA ENG. WORKS AIR COMP.
ELECTRO-CHEMICAL IND. CO., LTD.
FERRO ALLOY STEEL
AND CHEMICALS
KARATSU
FUTASE
KURUME
NAGASAKI
OMUTA
FUKUSHIMA
FUKUOKA
KANZAKI
WAKAMATSU
SHIMONOSEKI
KOKURA
MIIKA
NAKATSU
HIKOSHIMA
OKIRA
KYUSHU
KUSHIRA
KURE
HOJO
TAKAHASHI
FUJI
SHIKOKU
IZUS
IKUNO
NARUO
ARIMA
AMAGASA
KOBE
MINATO
WAKAYAMA
COAL MINES
COAL MINES
STEEL PLANT
OIL REFINERY
TAISHO MINING CO. COAL
MITSUI ZINC PLANT
MITSUI MIIKE COAL MINE
MITSUI DYE PLANT
COPPER MINES
MITSUBISHI COAL
MINE
ASANO CEMENT PLANT
SUMITOMO STEEL TUBE &
COPPER ROLLING CO.
ASAKI GLASS CO. LTD.
KOBE STEEL WORKS
PLANT
SHIPYARDS
MITSUBISHI SHIPYARD, DOCKS,
& ENGINE WORKS
MITSUBISHI MOTOR, AIRBRAKE &
ELEC. APPLIANCE PLANT
KOBE STEEL WORKS
KAWASAKI DOCKYARD CO.
SHIPYARD & ENGINE PLANT,
PLATE & SHEET MILL
AIRPLANE FACTORY
STEEL WORKS
LOCO. & R. R. EQUIP.
KAWAKI WHSE. CO.
KAWANISHI SOKO, K. K.
MORIMOTO WHSE. CO.
TOSHIN WHSE. CO.
MITSUBISHI WHSE. CO.
MITSUBISHI AIRPLANE CO.
WEST END OF CITY
KAWASAKI DOCKYARD AIRPLANE PLANT
KAWASAKI DOCKYARD, SHIPYARDS
HARIMA SHIPYARDS
HAIADO SHIPYARDS
MITSUBISHI SHIPYARDS
4 GAS & ELEC, PLANTS
71 METAL PLANTS
•156 MACHINE SHOPS &
MACHINE TOOL PLANTS
JAPAN STEEL TUBE CO. PLANT
OSAKA STEEL WORKS OF NIPPON
IRON WORKS, LTD.
SUMITOMA STEEL PIPE & COPPER
ROLLING CO.
METAL INDUSTRIES, LTD.
MITSUBISHI SMELT & REF. PLANTS
KOKUSON KOGYO CO. LTD. STEEL WORKS
KUBATA IRON WORKS
MITSUBISHI WHSE.
TOSHIN WHSE. CO.
SUMITOMO WHSE. CO.
IZUMI LEAD PIPE WORKS
NIPPON ALUM. WORKS
OSAKA IRON WORKS, SAKURAJIMA
SHIPYARDS
AIWAGA SHIPYARD
FUJINAGATA SHIPYARD
KIZUGAWA SHIPYARD
KAKUICHI RUBBER CO., TIRES
MIKUNI IRON WORKS,
AIR COMPRESSORS & MACH.
UJIGAWA ELEC. POWER CO.
JAPAN DYESTUFF MFG. CO.
COAL TAR BY-PRODUCTS
OSAKA YOGYO CEMENT CO.
ASANO CEMENT CO.
MANUFACTURING PLANT AREA
91 METAL PLANTS
173 MACHINE SHOPS & MACHINE
TOOL PLANTS
2 GAS & ELEC. PLANTS
METAL SMELTERS
GUN POWDER PLANT
WIRE MILLS
POWDER MAGAZINES
NAKAJIMA AIRPLANE PLANT
MITSUBISHI AIRPLANE ENGINE
PLANT
MITSUBISHI MOTOR, AIRBRAKE &
ELEC. SUPPLY PLANT
DAIDO DENKI SEIKOSHO STEEL FDRY.
TOSHIN WHSE. CO.
MITSUBISHI AIRPLANE PLANT
EAST SIDE OF NAGOYA HARBOR

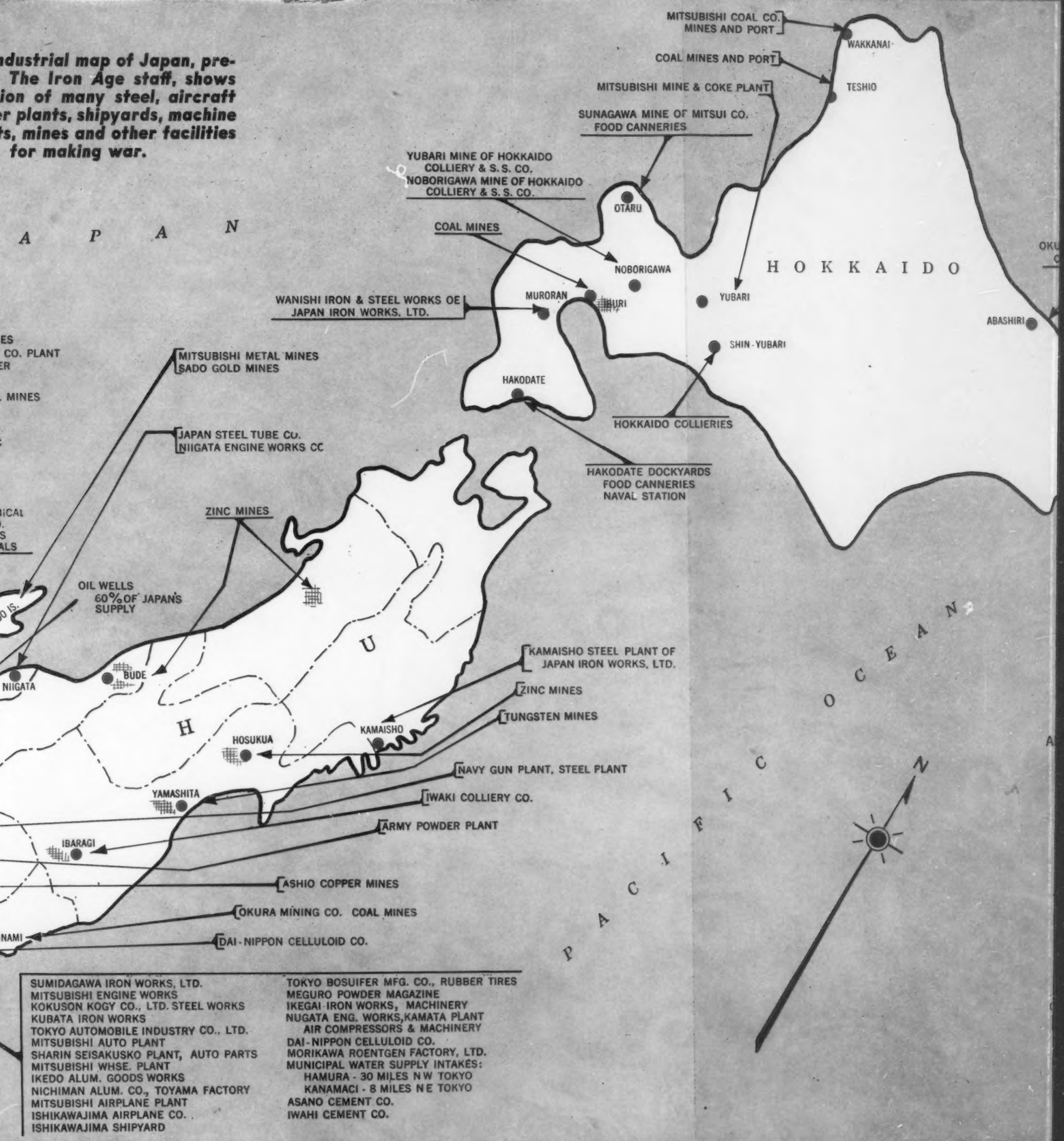
n Age Map of

JAPAN'S WAR PLANTS

. . . This industria
pared by The Ir
the location of
and power plants
tool plants, mines
for ma

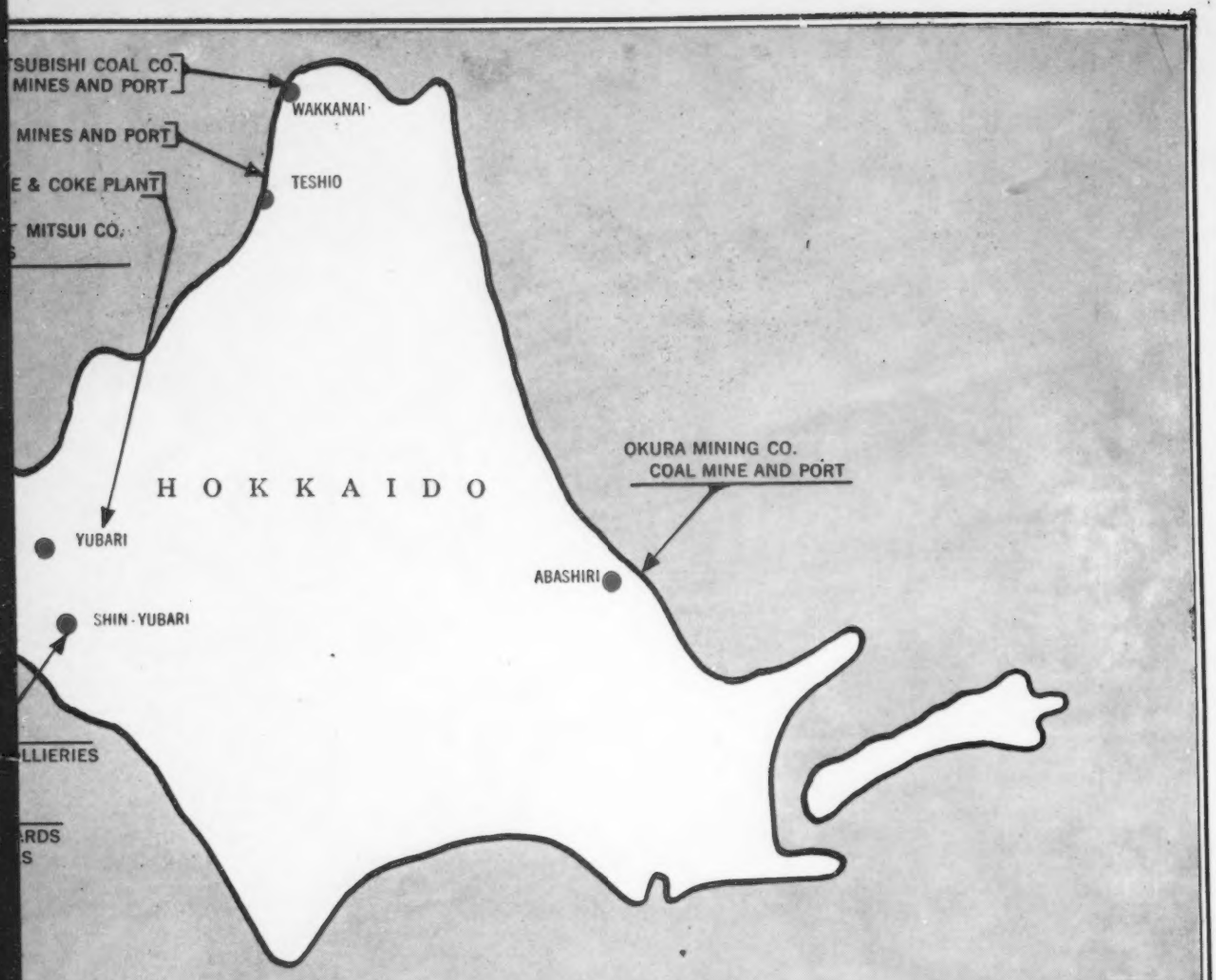


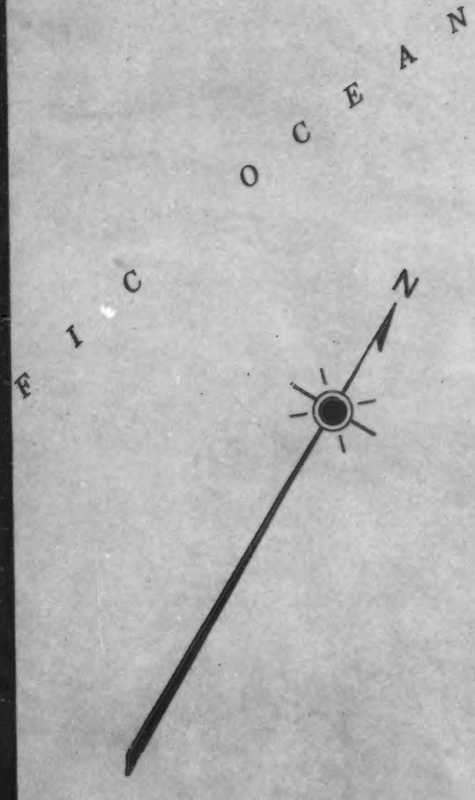
**ndustrial map of Japan, pre-
The Iron Age staff, shows
ion of many steel, aircraft
r plants, shipyards, machine
ts, mines and other facilities
for making war.**



SUMIDAGAWA IRON WORKS, LTD.
MITSUBISHI ENGINE WORKS
KOKUSON KOGY CO., LTD. STEEL WORKS
KUBATA IRON WORKS
TOKYO AUTOMOBILE INDUSTRY CO., LTD.
MITSUBISHI AUTO PLANT
SHARIN SEISAKUSKO PLANT, AUTO PARTS
MITSUBISHI WHSE. PLANT
IKEDO ALUM. GOODS WORKS
NICHIMAN ALUM. CO., TOYAMA FACTORY
MITSUBISHI AIRPLANE PLANT
ISHIKAWAJIMA AIRPLANE CO.
ISHIKAWAJIMA SHIPYARD

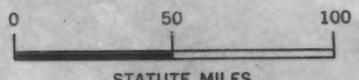
TOKYO BOSUIFER MFG. CO., RUBBER TIRES
MEGURO POWDER MAGAZINE
IKEGAI IRON WORKS, MACHINERY
NUGATA ENG. WORKS, KAMATA PLANT
AIR COMPRESSORS & MACHINERY
DAI-NIPPON CELLULOID CO.
MORIKAWA ROENTGEN FACTORY, LTD.
MUNICIPAL WATER SUPPLY INTAKES:
HAMURA - 30 MILES N W TOKYO
KANAMACI - 8 MILES N E TOKYO
ASANO CEMENT CO.
IWAHI CEMENT CO.

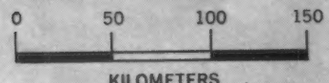




AIRPLANE DISTANCES TO TOKIO

PETROPAVLOVSK	1650 mi
JUNEAU, ALASKA	4011
APIA, SAMOA	4657
VLADIVOSTOCK	680
BOMBAY	4188
CALCUTTA	3186
MANILA	1863
DARWIN, AUST.	3367
GUAM	1589
LOS ANGELES	5470
MOSCOW	4650
NOME	2983
PANAMA	8423
SINGAPORE	3304
CHUNKING	1350
NEAR ISLAND, ALA.	2000





TOKYO: Tokyo was one of the four cities that felt the fury of American bombers on April 18. In the lower left of the photo is the Central Railroad station, the large white building behind the station is the post office, and at the right is the Marunochi building.

Mitsubishi interests operate the majority of the mines.

Generally, the steel industry in Japan has been located either close to the domestic coal supplies or along the seaboard where imports of ore and coal can be conveniently handled. The most extensive industrial coal deposits, particularly the Chikuho field, are situated in northern Kyushu, and it is close to these fields in Yawata, that the largest iron and steel producing plants, those of the Japan Steel Mfg. Co., are situated. From the island of Kyushu, especially from the company owned Futase mine, these works get about 4/5 of their coal supply.

The Japanese government has nurtured the steel industry, especially since World War I, with direct and indirect subsidies. For example, direct subsidies have been granted producers of iron and steel for use in shipbuilding and to ship builders. Among the leading private steel producers in Japan are: Japan Steel Tube Co., a producer of pig iron, bars, shapes, rails, pipe, and special steels; Kawasaki Shipbuilding & Dockyard Co., which produces among other things steel and castings for its own use; Kobe Steel Works, producers of bars, forgings, castings, and ordnance, and on the board of directors of this firm are several naval officers; Asano Shipbuilding Co., producers of ship plates and other materials used in ship construction; Kokura Steel Co., producers of steel ingots and castings.

Numerous other small companies specialize in such products as sheets, strip, wire, pipe, tubing, and many new producers of alloy steels have come into existence during the past several years. Several of these smaller private companies have iron producing facilities as well as iron ore and coal mines. The largest of this type of producer is the Japan Steel Tube Co., and within the past five years this firm is known to have greatly expanded its pig iron capacity. A list of the known steel plants in Japan, with the last published capacity figures, follows:

IRON, Net Tons	
Yawata Iron Works	758,300
Rinsai Iron Works	210,800
Kamaishi Mining Co.	261,800
Asano Dockyard Co.	57,800
Toyo Iron Works	170,000
Mitsubishi Iron Works	238,000
Penksihu Iron & Coal Co.	102,000
Aushan Iron Works	340,000
Total	2,138,600

STEEL, Net Tons	
Yawata Iron Works	1,137,000
Rinsai Iron Works	60,000
Nihon Steel Works	81,000
Kamaishi Mining Co.	144,000
Asano Dockyard	75,000
Nihon Steel Tubing Mfgrs.	211,500
Fuji Steel Mills	54,000
Azuma Steel Works	45,000
Oshima Steel Works	49,000
Tokyo Steel Works	18,000
Osaka Iron Works	67,500
Hamuro C. S.	14,000
Sumitomo Steel Works	59,400
Sumitomo R.C.S.T.	67,500
Kawasaki Car Mfg. Co.	40,500
Kawasaki Shipyard	330,750
Kobe Steel Mfg. Co.	152,400
Asano Kokuro Steel Works at Kokuro	90,000
Karatsu Steel Works	9,000
Futaba Steel Works	112,500
Total	2,931,054

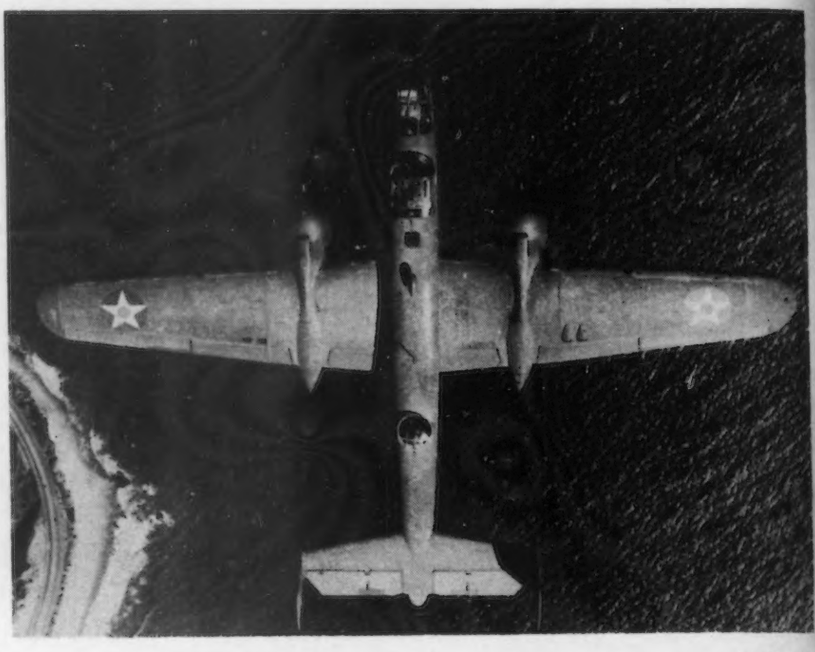
Shipbuilding in Japan is remarkable in that the industry is spread throughout the country,

with no less than 12 cities on all three of the major islands participating. However, Honshu island has the greatest number and largest shipyards in the nation. Kobe, Tokyo, Kanazawa, Yokohama, Osaka, and Hikoshima are the Honshu cities with shipyards, and the latest figures available (1936) showed that in these cities alone there were 56 shipways, with a possible 20 more in yards that did not indicate the number of berths. At Osaka, at the mouth of the Aji River, there is a concentration of shipyards, and the Hikoshima Yards, on the island of Hikoshima between Moji and Shimenoseki, build naval vessels.

The orient was the birthplace of gunpowder, and Japan, to keep her army and navy operating, has its share of powder plants and magazines. The Teikoku Gun Powder Mfg. Co., at Taketoyocho is a particularly large producer of powder for the army. There is another large plant at Iwagahana in Gumma prefecture. The Meguro Powder magazine in Tokyo is a storage place for Naval ammunition, while the Mitsubishi interests have an arms plant and possibly a powder plant at Nagasaki. Naval bases have been established at Hakodate, Nagasaki, Tokyo, Moji, and Niigati, as well as naval repair yards at Yokohama, Kobe, Osaka, and Fukuoka. These stations likewise may be used at the present time as ammunition depots.

Aircraft plants in Japan are being expanded, with new ones coming into production as quickly as possible. The most likely spots for these new ones would be close to the industrial centers. Furthermore, known plants are being expanded. Kawanishi Aircraft Co., has two plants, one at Naruo, and the other in Hyogo, both in the Hyogo prefecture. Mitsubishi aircraft plants are located on the east side of the Nagoya harbor, beside the airport; at Kobe, in the west end of the city; and at Tokyo. Also in Tokyo is the Ishikawajima Aircraft Co. plant and in Nagoya is the Nakajima Aircraft Co. plant, a large producer of fighter planes.

Electric power and water supplies in Japan are rather widespread. Tokyo Electric Power Co., has a plant on the Shinano River in Niigata prefecture, while the Ujigawa Electric Power Co., operates at 517,318 hp. plant at Osaka.



AP Photo

TOKYO BOMBERS?: Japanese imperial headquarters claimed that the planes that bombed Tokyo and three other cities on April 18 were 10 bombers of the North American, B-25, type, like this one.

On the Mimigawa River at Tsukahara, the Kyushu Electric Power Transmission Co., Ltd., has a large station, and the Kwanto Hydro-Electric Co., Ltd., has a generating plant at Makabe, in Gumma prefecture. The Japan Electric Power Co. has several stations, one of the largest of which is on the Hida River, in Gifu prefecture.

The Yanagawara station of this company is located on the Kurobe River, in Toyama prefecture, and develops 50,000 kw. for the cities

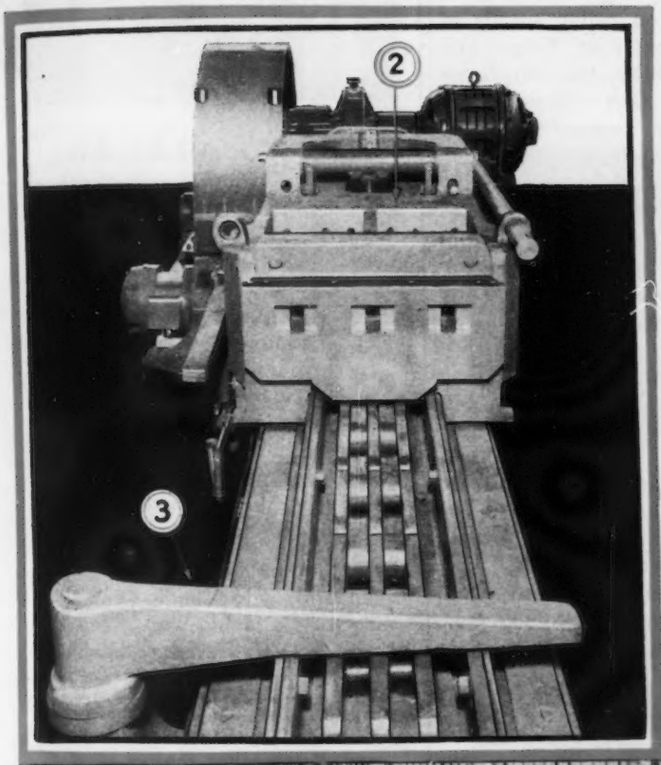
AIR RAID PRACTICE; Long before the coming of American bombers, Japan held realistic air raid drills. Here is an incendiary bomb being handled by air raid officials in front of the railroad station in Tokyo.

McKAY

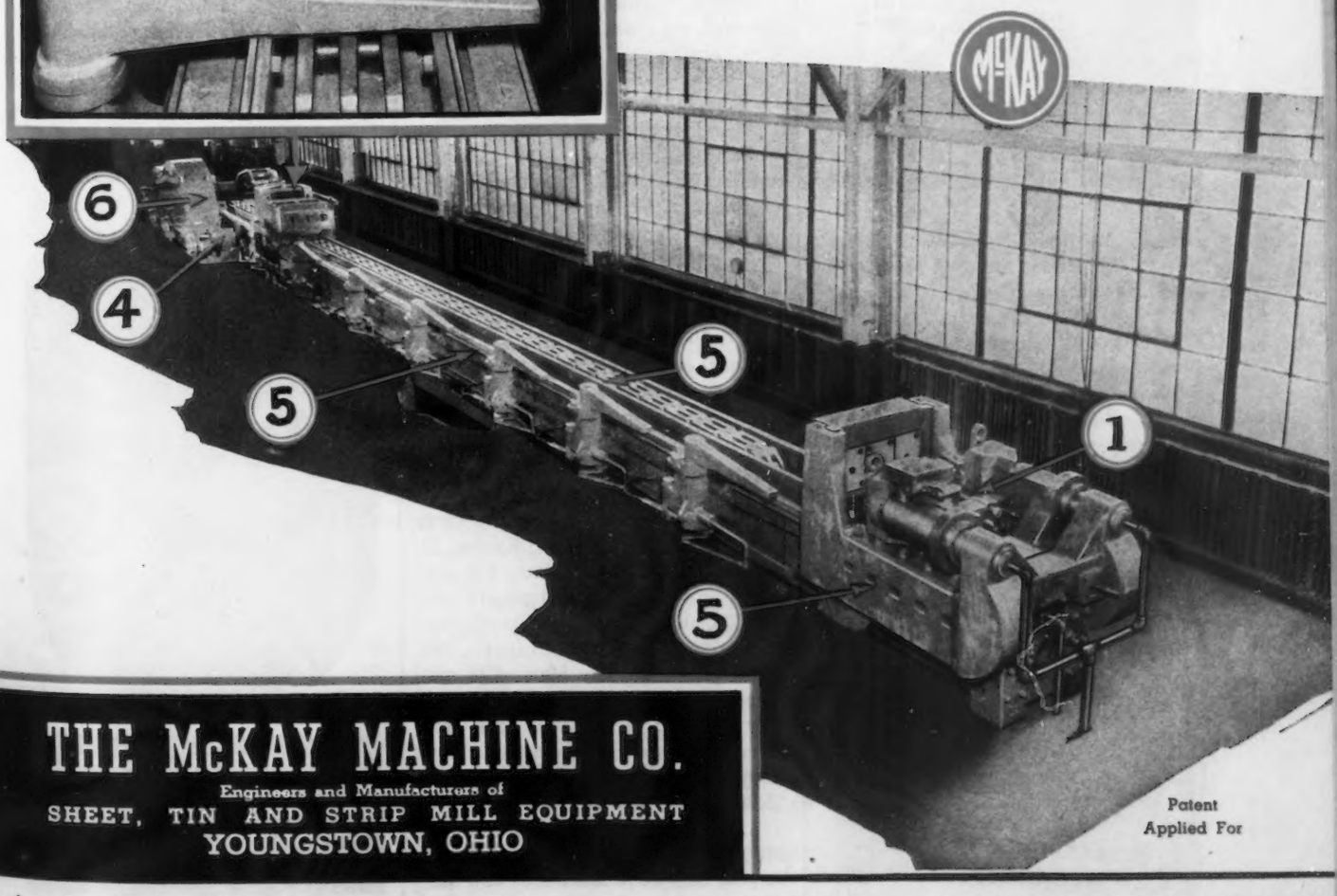
BAR DRAWBENCHES

(WITH OR WITHOUT)

PUSH POINTERS



1. Hydraulic push pointer. (Insures lower maintenance cost).
2. Automatic wedge type grip-buggy for single and multiple draw with quick change feature.
3. Hydraulic or pneumatic throw-off arm.
4. Hi-speed automatic grip-return with slow pull-in feature.
5. Steel construction throughout.
6. Constant or variable speed drive.



Patent Applied For

THE McKAY MACHINE CO.

Engineers and Manufacturers of

SHEET, TIN AND STRIP MILL EQUIPMENT

YOUNGSTOWN, OHIO

We also build: TUBE DRAWBENCHES, BAR SHEARS and ROTARY POINTERS

of Nagoya, Osaka, and Hokuriku, while the Komahi station, developing 72,000 kw. is located on the Sho River. Japan Electric Power Co., also operates a plant at Amagasaki, developing 140,000 kw. The Tokyo Municipal Water Works, with a 7.5 billion gallon supply of water for the city of Tokyo and surrounding areas, has two large water intakes. One of these is the Hamura intake, located 30 miles northwest of Tokyo and the other is the Kanamachi intake, eight miles northeast of the city.

For the most part, the interior of the islands making up Japan proper is mountainous, with streams flowing from the north-south backbone of the mountains to the eastern and western coasts. About 55 miles east by southeast of Tokyo is the famed Fujiyama, 12,391 ft. high. The great Inland Sea that separates Shikoku from Honshu, studded with many islands, must be approached either from the eastern end of Shikoku through the strait, Bungo-suide, or from the western end of the island, through the Naruto or Yura-kaikyo, two similar straits. Along the northern shores of the Inland Sea is a great hub of industrial activity, and it is only through these waterways that the cities of Hiroshima, Kure, Okayama, Kobe, Osaka, and Wakayama can be approached from the sea. Just 40 miles northeast of the city of Osaka is the large Biwa lake, close to which is Kyoto, another important industrial center.

Another interesting feature of Japanese industry are the listings in the latest available official Japanese Yearbook. At Kobe, 71 metal plants employ 6000; 156 machine and machine tool plants employ 23,000; four gas and electric plants employ 300. At Kyoto, 91 metal plants employ 2000; 173 machine and machine tool plants employ 56,000, and 22 gas and electric plants employ 300. At Nagoya, 284 metal plants employ 5000; 725 machine and machine tool plants employ 29,000; and three gas and power companies employ 200. Tokyo's 4500 metal shops employ 42,000; 6500 machine and machine tool shops employ 100,000, while 2000 metal plants with 44,000 employees and 1800 machines and ma-

chine tool plants with 50,000 employees are located in Osaka.

These figures indicate that, for the most part, plants fabricating metal, machine shops, and machine tool builders are small, and probably well scattered throughout the cities. Such industry is not concentrated as it is in the United States, and it is likely that many of the plants included in the Japanese estimates are one and two man shops.

All considered, heavy industry in Japan divides itself geographically into distinct patterns. Industry is concentrated in four areas that can be encompassed within four circles all less than 200 miles each in diameter. Within a radius of 100 miles from Tokyo are: Maebashi, Yokohama, Yokosuka, Nagoya, and other industrial cities. Within 100 miles of Osaka are: Nagoya, Gifu, Yokkaichi, Kyoto, Kobe, Wakayama, Okayama, etc. Within 100 miles of Fukuoka, the cities of Moji, Shimonoseki, Kurume, Nagasaki, Omura, Karatsu Saga, and other important cities. Going to the extreme north on Hokkaido island, Otaru, Muroran, and Hakodate are more spread out, but still within 200 miles of each other. From the northern tip of Japan to the city of Nagasaki the distance is only slightly more than 1200 miles.

Non-War Use of Steel Seen Completely Halted Soon

Chicago

• • • **In answer** to the direct query, "Will there possibly be steel available for non-war manufacture toward the end of this year?" a top steel executive here answered "no." He went further and predicted that sheet production may soon vanish almost to the zero point and hinted that his own company might soon be forced to close its sheet operations and devote the entire strip mill capacity to plates. In view of the fact plate buyers are being ordered by the government to accept plates from strip mills with mill edges, steel producers will be able to increase plate production from this source. Already mills here have had their plate quotas on strip mills raised considerably. In one case where the quota was increased by 10,000 tons for April, the effect will probably be to raise the mills leveling off on orders at A-1-f up to A-1-b.

Iron Ore Consumption Rebounds During March

Cleveland

• • • **Iron ore consumption** by American blast furnaces increased to 6,899,667 gross tons, against 6,222,583 gross tons consumed during the shorter month of Febrary, according to the Lake Superior Iron Ore Association. However, March consumption was below the January record of 6,960,303 gross tons. Pig iron production for March was reported slightly above the January total. Apparently smaller use of ore in open hearths occurred during March. This possibility is strengthened by the fact that the scrap situation was somewhat improved in March, thereby tending to reduce open hearth requirements for ore.

Stocks of ore on hand at U. S. furnaces and Lake Erie docks totaled 19,550,606 gross tons, compared with 17,258,038 gross tons a year earlier. On April 1, 174 American blast furnaces were in operation and seven Canadian units were in blast, while seven American furnaces and one Canadian unit remained idle.

Canadian consumption figures for March, 1942, were not revealed, due to the tightening of restrictions by Canadian censors, but it is estimated that some 200,000 tons were consumed in March, as against the reported total of 180,779 gross tons for February and 198,120 gross tons for January.

March Structural Bookings Biggest Since June, 1941

• • • **March bookings** of new orders for fabricated structural steel, amounting to 236,791 tons, were the largest of any month since June, 1941, according to the American Institute of Steel Construction. They compared with 226,978 tons for the previous month, and 206,072 tons for March of last year. First quarter total of 645,573 tons was 98 per cent as large as bookings for the same period last year.

Shipments of 184,715 tons in March compared with 162,007 tons for February, and 170,161 tons for March of last year. Shipments for the first quarter, totaling 512,901 tons, were 3 per cent greater than for the first quarter of 1941.

T. C. I. Blows in New Stock, Increasing Capacity 17%

Birmingham

• • • **A far-reaching** program of expansion by Tennessee Coal, Iron and Railroad Co. virtually has reached completion with the blowing in of a new blast furnace, which will increase the pig iron capacity of T. C. I. by 17 per cent.

The program, touching many important phases of the company activities, was announced Nov. 13, 1940. It has been financed wholly by U. S. Steel.

Already completed, according to Robert Gregg, president, are enlargements of production capacities at ore mines, coal mines and quarries, including installation of a considerable amount of new mechanical equipment, and construction of a battery of 73 by-product coke ovens.

Actual construction of the new blast furnace was started April 18, 1941. It is the first blast furnace in the territory with an all-welded outer shell.

Meanwhile, another program was announced last month which embraces construction of still another battery of 73 by-product coke ovens, opening of another coal mine and installation of electrolytic tinning facilities.

Aluminum Co. of Canada Plans $100 Million Plant

Ottawa

• • • **Aluminum Co. of** Canada Ltd., is investigating power resources in Manitoba with a view to establishing a plant in that province. No financing by the government will be involved. The investment will be approximately $100,000,000. The proposed plant would be in addition to, and not a replacement of, the company's Quebec plant.

New Aluminum Sheet Mill Being Built at Chicago

Chicago

• • • **Ground has been broken** for the new aluminum sheet mill here to be operated by the Aluminum Co. of America. Plant will be one of the largest in this metropolitan area, will employ about 7000 people. Product will be aluminum sheets, alloyed with magnesium, to make duralumin for aircraft structures.

WPB Follows C-I Plan For Employee Training

Pittsburgh

• • • **According to Carnegie-Illinois** Steel Corp., a recent bulletin of the War Production Board, labor division, dealing with employee upgrading and training, was modeled after a plan installed as a part of the company's effort to expand production of war materials.

With more than 25,000 employees added to the payroll during the past 18 months, the company, in order to meet the expanding training requirements, instituted a training program and now has its entire personnel participating. More than 5000 foremen take part in supervisory development; approximately 1000 apprentices are enrolled in regular four year trade courses; 300 college recruits, designated as practice apprentices, are assigned to observation and job experience orientation training; several hundred learners and helpers are receiving organized training for production or maintenance positions; 8000 employees are enrolled in evening trade extension classes; and the remaining employees, totaling about 135,000, are being upgraded by supervisors and instructor foremen or are receiving special job instruction.

Construction Begins on Republic Division's Plant

Pittsburgh

• • • **The Rust Engineering Co.** has begun construction of a $200,000 addition to the plant of Union Drawn Steel Division of Republic Steel Corp., Beaver Falls, Pa.

The Rust Furnace Co., subsidiary of the engineering company, will build a triple-fired Rust billet and bloom heating furnace for Copperweld Steel Co., at Warren, Ohio, at a contract figure of approximately $190,000.

New Chemical Price Chief

• • • **R. G. Phelps,** professional chemical engineer who built explosive plants in the first World War, has been appointed as price executive of the chemical section of OPA. He succeeds Clarence W. Farrier, who has been named technical director of the National Housing Agency.

Contract Possibilities Are Listed in Chicago Area

Chicago

• • • **About 600** potential sub-contractors in the area have received copies of a "directory of contract possibilities." It discloses that there are 19 private prime contractors seeking to sublet work on 85 contracts, and that the Chicago ordnance district is prime contractor on nine jobs. The private firms are Crane Co., Automatic Electric Co., Automatic Transportation Co., Arens Controls, Inc., Athey Truss Wheel Co., the Sterling Tool Products Co., Stiger-Hilton Co., Barrett-Cravens Co., Wells-Gardner & Co., American Locomotive Co., Chicago Electric Mfg. Co., Miehle Printing Press & Mfg. Co., Meadows Division of Electric Household Utilities Corp., Link-Belt Ordnance Corp., Pettibone-Mulliken Corp., and Continental Can Co., all of Chicago; Allis-Chalmers Mfg. Co., and Kearney & Trecker Corp. of Milwaukee; and Blaw-Knox Co. of Pittsburgh.

The ordnance district is seeking capacity on light milling machines, bar lathes and one and two spindle bench type drilling machines.

Riehle Still Making Line of Testing Machines

• • • **The Riehle** Testing Machine Division of American Machine & Metals, Inc., East Moline, Ill., has not discontinued manufacturing the major part of its line of tension-compression testing machines, as was reported in THE IRON AGE April 9. It will not begin manufacture of a new line of machinery. Orders on the company's books for precision hydraulic universal testing machines are so heavy that, in fairness to buyers, additional bookings will not be made until the backlog is reduced so that reasonable delivery requirements can be met.

Stamp Idle Tools, Says SWOC

• • • **Every idle machine** should be stamped with a sticker saying "This Idle Machine Helps Hitler!" suggests the Steel Workers' Organizing Committee (CIO) in an editorial in "Steel Labor," its monthly publication. It is labor's job to stamp the idle machines, says the editorial.

Lead Savings Suggestions Given by Advisory Group

Columbus, Ohio

• • • **Methods for saving** at least 100,000 tons of lead annually have been suggested to the WPB by H. W. Gillett of the Battelle Memorial Institute here. Recommendations of an advisory committee on metals and minerals, as contained in Mr. Gillett's report, included: 1, limiting use of lead foil; 2, substitution of other pigments; 3, reduction in thickness of sheathing of underground cables; 4, substitution of asphalt paint to protect structural steel from rust; and 5, reducing lead in storage batteries. Normal consumption of lead includes 30 per cent for storage batteries, 20 per cent for pigments, 12 per cent for cable sheath, 8 per cent for building, 6 per cent for ammunition, and 5 per cent for high test gasoline.

Tool Conservation Pushed By Disston Card System

Philadelphia

• • • **Since its "Conservation Control Plan"** was first announced (The Iron Age, Jan. 22), Henry Disston & Sons, Inc., has placed the information contained in its original booklet in the form of cards which individual workmen can carry in his pocket. There are now 45 Conservation Control cards available, printed on varicolored stock according to the subject matter or type of tool.

The object of the plan is to obtain more efficient results with tools and to prevent tool breakage. Each card lists typical types of tool failure, the probable causes and their correction. Items covered include hacksaw blades, milling saws, band saws, tool bits, files, hot saws and various types of woodworking saws and knives. The latest set of six cards added to the series cover the proper heat treatment and use of tool steels, including high speed, air, water and oil hardening types. Both the cards and the booklet telling how to use them are available free.

90 Million Ton Capacity Estimated for Ore Fleet

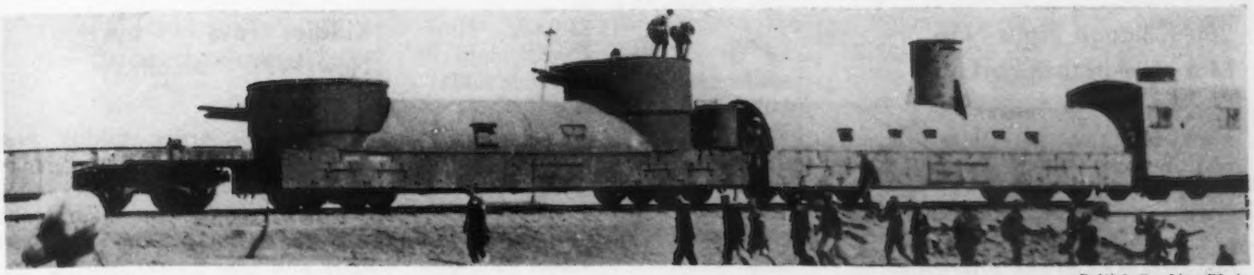
Cleveland

• • • **Two hundred and** ninety-nine American vessels with trip capacity of 2,729,540 gross tons, will enter the iron ore trade during the current season, according to C. C. Lindeman, statistician for M. A. Hanna Co. This is a gain of seven ships over 1941. The ore fleet this year will probably make close to 33 trips on the average, indicating a carrying capacity of about 90,074,820 gross tons of ore, based on 20-ft. draft.

Wood Culvert Designed By American Rolling Mill

Middletown, Ohio

• • • **American Rolling Mill Co.** has designed an all wood culvert. W. W. Sebald, vice-president and assistant general manager, revealed the culverts are in production and are a solution to the problem of building drainage structures without the use of critical materials. This new type culvert is intended to outlast a five-to-ten year emergency period.



British-Combine Photo

PROTECTION FOR CHINA: These armored trains protect the Chinese troops and supplies from enemy air attacks, their steel walls and revolving gun turrets making them forts on wheels.

Otis Shareholders O. K. Plan for Sale to J. & L.

Cleveland

• • • **E. J. Kulas,** president of Otis Steel Co., announced that at a meeting of shareholders April 24, the plan for the sale of substantially all of the assets of the company to Jones & Laughlin Steel Corp. and the distribution of the proceeds among the company's shareholders was approved. Of the 832,112 shares of capital stock represented at the meeting 805,245 shares or approximately 97 per cent voted in favor of the plan. Kulas said that as yet no date has been set for consummation of the plan.

Pittsburgh Steel Reports Net Profit of $645,334

Pittsburgh

• • • **Pittsburgh Steel Co.'s** net sales for the first quarter of 1942 amounted to $15,985,740 and the company reported a net profit after all charges of $645,334, which compares with a net profit of $889,700 in the first quarter of 1941.

Blaw-Knox Earnings Rise

Pittsburgh

• • • **Blaw-Knox Co.** earnings for the quarter ended March 31, before providing for state income tax and Federal income and excess profits taxes, amounted to $1,661,174 as compared with $1,120,821 for the corresponding 1941 period. After providing for Pennsylvania income tax and Federal income and excess profits taxes in an amount substantially in excess of such an amount computed on the basis of the 1941 rates, net profit was $276,624 or 21c. a share of the outstanding capital stock for the quarter ending March 31.

200 Chicago Firms Now Making Aircraft Parts

Chicago

• • • **More than 200** Chicago area manufacturers are making aircraft parts for the war effort, causing a growing belief that this area may be one of the nation's big aircraft centers following the war. There is as yet, however, no volume production of finished craft under a Chicago firm name. Final assembly is lacking. Howard Aircraft is the only plant in this section turning out complete planes—and these are ambulance planes.

But the fact that before the war even parts manufacturers were scarce here encourages the belief, that it is the intention of the government to make this area as much an aircraft center as it is the hub of railroad equipment manufacture.

Kiddies' Toys Hit by New WPB Prohibition

Washington

• • • **WPB's order** taking nice metal toys away from the kiddies in realistic war terms is expected to "save" 100,000 tons of iron and steel, 2000 tons of copper, copper alloy and brass, 1000 tons of lead, 3000 tons of zinc and 3000 tons of rubber and "huge quantities of vital materials." The WPB order, effective June 30, bans the fabrication of toys containing "critical materials." It prohibits production of toys made of certain "prohibited materials."

The WPB handout on the order, taking a sadistic direction aimed at small children, said in the course of a 1000-word mawkish blurb:

"By and large, the infant is expected to suffer from toy restrictions more than any other age groups because of the complete lack of rattles, teething rings and other gimcracks made with plastics having a formaldehyde base, and of brightly-colored rubber balls."

Institute to Hear Adams And Tower at 51st Meeting

• • • **Program of the** 51st general meeting of American Iron and Steel Institute, to be held in New York on May 21, will feature addresses by Walter S. Tower, president of the Institute, and C. E. Adams, chief of the Iron and Steel Branch of WPB.

Both men will speak at the morning session of the meeting. Attendance at all sessions of the meeting will be restricted to individual members of the Institute.

Two round-table sessions will be held simultaneously in the afternoon.

One session will be devoted to technical problems faced by the steel industry in its war efforts, and the other will be concerned with industrial relations topics.

Shipyard to Double New Plant

North Tonawanda

• • • **Tonawanda Island** Shipyards, Inc., plans to double the size of its new boat yards on Little Island. The concern has acquired buildings and docks of the old Hill-Manning Co.

Book Reviews

Plant Production Control. This new text on the subject of "Plant Production Control" does not advocate any one system in use at present, but attempts to resolve the problem into the functions which are necessary in controlling production in almost any situation. The book, which was written by Charles A. Koepke, professor of industrial engineering, University of Minnesota, and published by John Wiley & Sons, Inc., New York, was based on case studies in about 15 plants, all of which had a pattern of production control functions which tended to be more or less constant.

After analyzing the scope of production control and its organization, the author takes up each factor step by step. Besides some of the primary factors of economic lot sizes, scheduling, machine load charts, dispatching, material handling and centralized control of production, such broad subjects as research, product design and analysis, and the selection of materials are discussed. Other chapters cover production and expense budgets, inventory control, waste elimination, depreciation and obsolescence, and plant and machine replacement policy, as well as methods and standards in the plant. The book sells for $4.

Production Engineering. A book under the title "Production Engineering" has been written by Earle Buckingham, professor of mechanical engineering, Massachusetts Institute of Technology, in which an attempt is made to correlate all the factors that enter into this broad subject. The book is divided into three parts: preparation for production, production operation control, and supporting activities.

Under the first head comes production design, planning of equipment, tool design and the proving of production design equipment. Under the second head comes production, selection, training and direction of operators, quality control and cost reduction. Included under supporting activities are standardization, factory costs, and process and product development. In general the book deals with principles rather than specific applications. This book is also published by John Wiley & Sons, Inc., New York, and sells for $2.50.

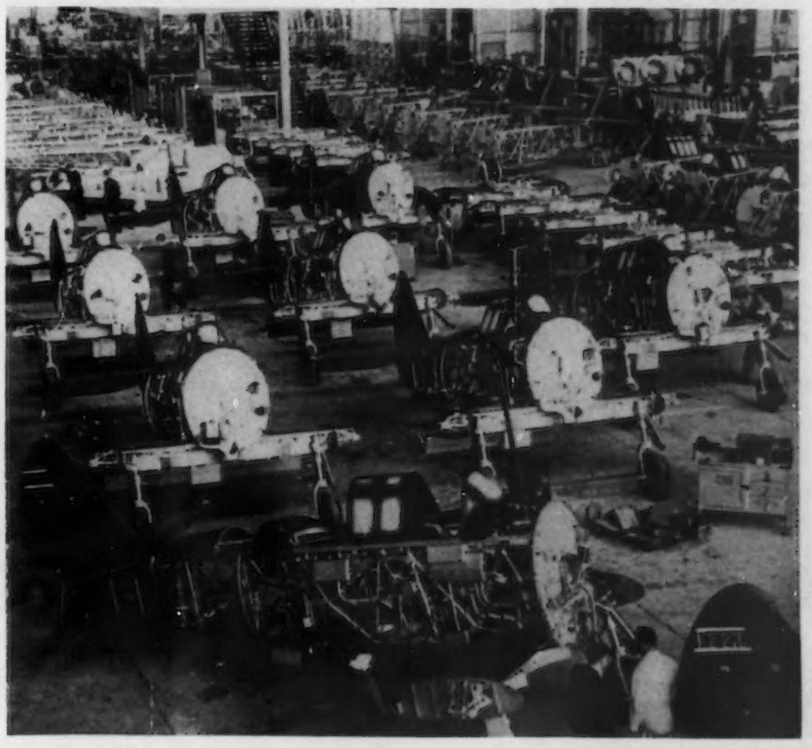
Machine Shop Mathematics. McGraw-Hill Book Co. of New York has just issued a volume on Machine Shop Mathematics by Aaron Axelrod, teacher of machine shop mathematics of the Bayonne (N. J.) Vocational and Technical High School. The book was written as a text book for vocational schools, but can readily be applied in industrial apprenticeship courses. The book begins with a discussion of measuring instruments, then takes up problems in weights and measures as encountered in the machine shop. Geometrical construction, graphical charts and shop trigonometry follow. Some of the practical problems involved in belting, speed of pulleys and gears, speeds and feeds of various machine tools, and problems encountered in lathe work and milling machine operation are then presented.

Chemical Dictionary. Compiled primarily for the benefit of people not educated along chemical lines, but who have to deal with chemical terms in their daily work, the third edition of the condensed "Chemical Dictionary" has been compiled by the editorial staff of the Chemical Engineering Catalog, and has been published by the Reinhold Publishing Co., 330 W. 42nd Street, New York. The volume contains about 750 pages and is priced at $12. Over 6000 new items have been added since the second edition appeared in 1940. One of the features of the book is the large number of trade or brand names which have been identified in the present edition. Another feature is the inclusion of typical specifications of standard commercial products.

Shop Theory. A popular text prepared by the staff of the Henry Ford Trade School has been made available to other schools and industries through the McGraw-Hill Book Co., New York. The paper bound, revised edition sells for $1.25. The book is largely written in question and answer form and through the use of large numbers of illustrations describes and identifies most of the machine tools and small tools and cutters found in industry. Considerable "machine shop arithmetic" is included in connection with application of the various machines.

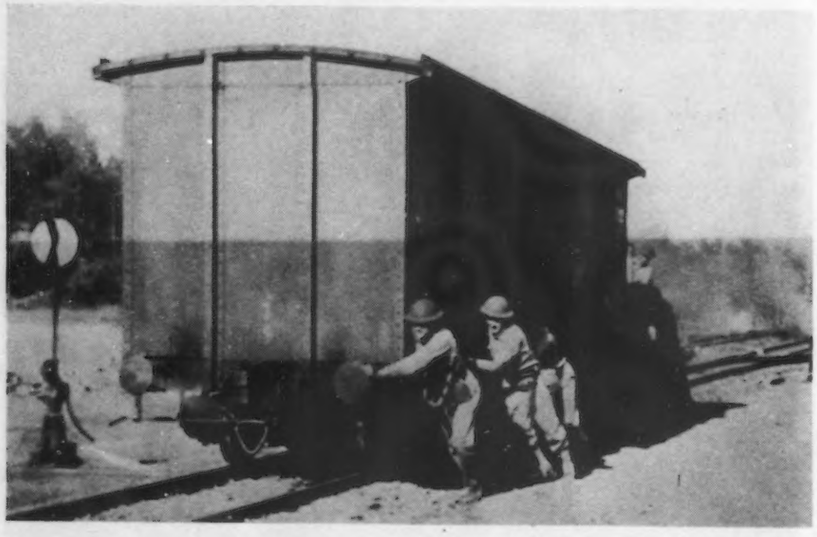
AUSSIE'S "WIRRAWAY'S": Australia's plane factories are going on the production line basis. It took 16 months to build the first 100 Wirraway planes, but the second were built in 3½ months, and the production rate is still increasing.

International News Photo



International News Photo

READY FOR ACTION: With gun crews at their stations, this unit of the Atlantic Fleet is doing its job in keeping vital sea lanes open so that war materials can reach Britain and Russia.



Harris & Ewing Photo

AT THE ROAD'S END: With railroad equipment destroyed by Jap dive bombers, these American soldiers move the cars by hand to salvage ammunition for the last ditch fight. The picture was made at Lubac, Pampanga, P. I.

Ship Lag Due to Lack Of Plates, F.D.R. Says

Washington

• • • **Much of** President Roosevelt's discourse at the White House press conference last Friday was about steel and scrap. The primary reason for the merchant shipbuilding program being behind schedule is the shortage of steel and there can be no question about that, he said.

The steel shortage was declared to extend all over the country. The President said it had been in existence for a long time. But production is being increased and may have to be increased still further than now planned, he pointed out. The President, however, reminded the correspondents that because of the tremendous proportions of the combined shipping programs of the Maritime Commission and the Navy it was natural that a shortage of plates and shapes had resulted.

Regarding the testimony last Thursday before the Truman Senate Investigating Committee by Admiral Emory S. Land, Chairman of the Maritime Commission, that the merchant shipbuilding program has been delayed because of loafing on the part of labor and management, the President said he thought the failure of the program to be up to schedule was due almost entirely to the steel plate shortage. Mr. Roosevelt added that Admiral Land's statement was a good burr under the tail of labor and management.

Admiral Land said that while steel mills had not made up a backlog of 169,000 tons of plates, the shipyards are now getting all the plates they can use.

Pleading for a national labor policy, the Admiral asked for a better morale and an end of loafing.

"We must put a stop to all this infernal agitation about closed shop, open shop, wage increases, whether workers join this union or that union," the Maritime Commission Chairman said.

The steel scrap shortage, the President thinks, is not serious, because there is plenty of old material around the country that only needs to be collected. There is much old rail, for instance, it was pointed out, in 25 to 30-year old unused sidings for empty cars. Also, it was stated, there is a lot of old

machinery on dumps to show what scrap can be dug up.

The two-year production program providing for 185,000 airplanes, 120,000 tanks, 55,000 anti-aircraft guns and 18,000,000 deadweight tons of merchant ships, the President said, is working out extremely well, considering that the program was called fantastic when he announced it last January. He declared that an even greater production program may be necessary.

The President said he could not give assurance that the current expansion of the steel industry will be sufficient for the war needs. By the time new plants are completed, Mr. Roosevelt pointed out, it might be necessary to build additional facilities. The iron and steel expansion program as approved calls for an increase of 10,000,000 net tons in steel ingot and 14,000,000 tons in blast furnace capacity. If completed steel ingot capacity will be 98,200,000 tons and pig iron capacity will be 74,000,000 tons.

The President disclosed that he had been concerned that there was too much civilian use of steel. He said he requested WPB to check the situation and was told that the only civilian steel being made was for ultimate war use. The President said he told the WPB officials that he wanted the check made anyway.

People who one year ago said that there was plenty of steel, the President declared, did not and could not have any conception of the production needs lying ahead.

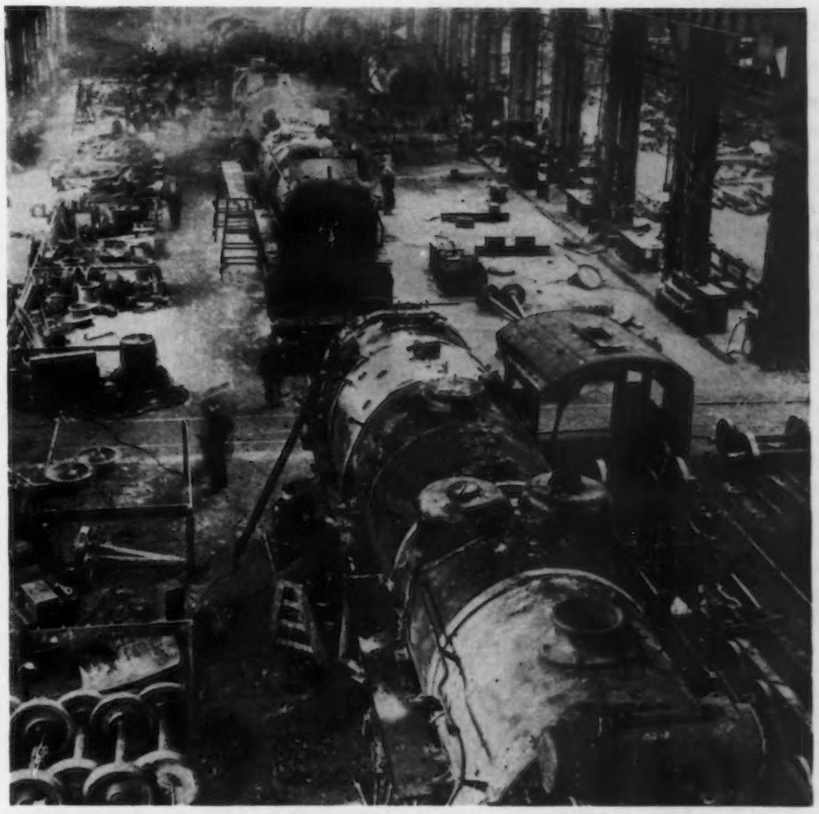
Destroyer Delivered 5 Months Ahead of Contract

• • • **Delivery more than** five months ahead of the contract date was made this week of the 1,630 ton Destroyer Lansdowne to the United States Navy at the Navy Yard in Brooklyn by the Federal Shipbuilding & Dry Dock Company, a subsidiary of the United States Steel Corp.

MRC to Buy Mercury

Washington

• • • **Metals Reserve Co.** has concluded arrangements to purchase surplus spot mercury from current domestic production at $192 per flask f.o.b. New York, through the George Uhe Co. and Garrigues, Stewart & Davies, Inc., both of New York.



AP Photo

GET IT ROLLING: Intended a year ago for the scrap heap, these locomotives at the New Haven Railroad's repair shop are now undergoing assembly line refitting. Passenger and freight cars, discharged long ago, are likewise being brought back into condition for service.

Harris & Ewing Photo

MACARONI WITH OOMPH: The macaroni coming from this press happens to be smokeless powder being made in an Army Ordnance Department arsenal. The next step is the cutting machine which reduces it to lengths standard for various types of gun ammunitions.

Shipbuilders Taking More Mill Edge Steel Plates

• • • **Efforts of wide** continuous strip mill operators to have some ship builders accept mill edge plates instead of sheared edges in order to expedite plate and ship production, have borne fruit and it is expected that more ship builders will accept band edge and flame cut them in their own plants in the near future.

It had been found that some ship builders who had ordered sheared plates actually flame cut this material during the fabrication of the ships. By making as much band edge plate tonnage as possible, the capacity of wide strip mills is enhanced considerably since heavier plates than can be handled by the shearing lines of the mill could be produced.

Although all ship building yards are not equipped for flame cutting, it is said that a substantial number would be able to accept mill edge plates in place of sheared edge material, and as a result deliveries would be expedited since material would not pile up at the limited shearing operations at the finishing end of the strip mills. In fact it is said by some sources that the increased acceptance of mill edge plates by ship builders may hasten the long sought goal of 1,000,000 or more tons of plates a month from the steel industry.

A ship yard on the West Coast which participated in experiments on band edge plates for ship building found that they could bevel, double bevel, and cut straight edges to complete satisfaction by flame cutting with its own facilities. Camber, it was said, was held to such a minimum by care at the mill that it was no obstacle to successful utilization.

C-I Gets All-Navy E

• • • **As evidence** of Carnegie-Illinois Steel Corp's all-out effort in the production of war materials, J. L. Perry, president, announced April 23 that the company has been awarded the All-Navy "E."

In addition to production for the Bureau of Ordnance, Navy Department, Carnegie-Illinois recently has been officially commended for its production record for the Bureau of Ships.

Scott, Once Wheeling Chief, Is Dead at 76

Wheeling, W. Va.

• • • **Isaac MacBurney Scott,** 76-yr.-old pioneer in the industrial development of the northern panhandle and former president of Wheeling Steel Corp., died early this week after a short illness. Outstanding achievement credited to Mr. Scott was the development and pioneering of cold reduced tin plate in the late twenties and early thirties, the production of which was started more than a decade ago at the Yorkville plant of Wheeling Steel. As a result of this development in the short space of 10 years, production of cold reduced tin plate has reached the point where practically 90 to 95 per cent of tin plate is being made by the cold reduction method, although war conditions have brought in many of the older hot pack units.

Mr. Scott spent most of his life in Wheeling and was chairman of the board of the Sharon Tube Co., president of the Buckeye Rolling Mill Co. and one of the receivers for the Follansbee Steel Co. of Follansbee, serving until the concern's reorganization.

Curtiss-Wright to Build Plywood Army Cargo Ships

• • • **The Curtiss-Wright** Corp. is planning to construct cargo transport ships for the Army, the fuselage, wings, and other parts of which will make use of plywood and various non-essential materials, according to Guy W. Vaughan, president, in his annual report to stockholders.

The new ships are designed for transporting both men and supplies, and will be especially useful in getting materials and troops quickly from one place to another. Much of the work on the ships will be subcontracted, since the design permits construction and sub-assembling of parts in plants of furniture manufacturers and other wood working organizations.

No More Nail Heads for Shoes

Washington

• • • **Shoe manufacturers** were asked recently not to use steel nailheads or brads to decorate uppers and platforms of women's shoes.

Hydraulic Press Plants Idle in 2-Day Strike

Mount Gilead, Ohio

• • • **Two plants of the** Hydraulic Press Mfg. Co., 100 per cent engaged in war work, were made idle on April 24 and April 25, due to a walkout by members of the International Association of Machinists, an A.F.L. affiliate. The walkout, which union representatives contended was not a "strike," came without warning in the midst of negotiations for a new contract between the management and union members. With approximately 90 per cent of the plants' 380 shop workers belonging to the union, members are attempting to secure a closed shop from the management.

United Engineering to Build Plant at New Castle

Pittsburgh

• • • **United Engineering** & Foundry Co. will construct a large foundry and machine shop at New Castle, Pa., as a result of current unlimited demand upon the company for the development and production of mill equipment, according to George T. Ladd, president. The plant will be built at the expense of the government and operated under lease.

ASM Convention May Go to Cleveland

Cleveland

• • • **Edward C. Brennan,** executive vice-president, Cleveland convention and visitors' bureau, announced that the American Society for Metals annual convention would be held in the Public Hall here probably from Oct. 11 to 16 this year.

J. & L. Profit $2,491,718

Pittsburgh

• • • **Jones & Laughlin** Steel Corp. reports for the quarter ended March 31, subject to annual audit and adjustment, a consolidated profit for the corporation and its subsidiaries of $2,491,718 after all charges, including depreciation, depletion, interest, and taxes. This compares with a profit of $4,160,507 reported for the corresponding 1941 quarter.

Amendments to Steel Order Requires Filing of New Forms

Washington

• • • **With the recent** amendments to the general preference order M-21, covering iron and steel products, two new forms, PD-138 and PD-139, have been issued, effective May 1. Form PD-138 is a report of shipments of iron and steel products and PD-139 is a report of unfilled orders and contracts for iron and steel products requested for shipment during the month.

All producers of carbon and alloy steel products and iron products covered by the amended general preference order M-21 are required to file monthly forms PD-138 and PD-139. Reports of shipments on PD-138 must reach the Bureau of Census, Washington, by the 15th of each month, and reports on unfilled orders on PD-139 by the 10th of each month. The first report on shipments for the month of May must be in by June 15, while the report on unfilled orders requested for shipment in May and June must reach the Bureau of Census by May 10.

A separate report for each of the products listed under "Iron and Steel Products," in Appendix A to the report is required for each company for each of the following grades: All grades combined, including carbon grades; stainless steel grades; electric furnace alloy grades; open hearth alloy grades. Reports are required for each subsidiary company, and a consolidated report should not be submitted. Three copies of each report are to be submitted, and reports should exclude shipments between subsidiaries of the same company for further finishing of a product. The subsidiary that ships the final finished product, if such product is shown on the Appendix A list, should report it.

Shipments to or unfilled orders from other divisions, plants, or subsidiaries for further finishing into other products contained in the list shall be excluded from all reports, but if not contained on the list shall be reported. In reporting the "maximum monthly capacity" the net tons of each product which could be produced in a 160-hr. work week should be entered, assuming availability of raw materials and exclusive use of facilities for the product.

Delivery Dates

• • • **Applications for** priority assistance which do not specify a required delivery date will hereafter be returned to the applicant by the WPB. An amendment to P-1 requires specification in the priority application of the latest date on which the items in connection with which the priority assistance is requested can be delivered to meet contract obligations or production schedules. Individual applications on form PD-1A that specify delivery "immediately" or "at once" instead of a definite date will not be considered.

Fishing Tackle

• • • **Non-commercial** fishing tackle manufacture is restricted after May 31 by WPB order L-92 which bans the use of metals, plastics, and cork in the manufacture of this equipment. Companies in the interim may only process 75 per cent of the iron and steel they used in a corresponding period in 1941. Fish hooks may be manufactured after June 1 at a rate of 50 per cent of 1941 production. No limitation on fish hook production was imposed until June 1.

WPB Metal Survey

• • • **A first quarter** survey of metal use in the United States and of anticipated requirements for the third quarter, 1942, is being undertaken by WPB. As reported briefly in the non-ferrous section of THE IRON AGE last week, data will be listed by consumers on form PD-275 and returned to WPB by May 15. Basic information called for on the form includes: Inventory of metals on hand Dec. 31, 1941; amount received during first quarter; amount put into production during first quarter; inventory on March 31; estimate of amount to be put into production during third quarter; shipments of products during first quarter analyzed by preference ratings; and the anticipated shipments during the third quarter.

Used Rail and Joints

• • • **Used rail** of relayer, re-roll, or scrap grade may not be disposed of without authorization of the WPB, according to order L-88. The restriction does not prevent a railroad from using rail in its own tracks. The order also establishes a scale under which users of new replacement rail must set aside a certain amount of used rail, based on percentages of new rail received. The required number of joints for laying the used rail must be put into a pool. It is expected that WPB will allocate rail from the frozen stocks of used rail, as applications are received.

Industrial Machinery

• • • **To avoid** disruption of schedules in plants preparing to convert to the output of war supplies, WPB removed, until May 15, restrictions on production of critical industrial machinery listed in order L-83. Provisions of the order remaining, however, make it unlawful for manufacturers or distributers to accept orders for such equipment or to make deliveries without WPB approval.

Air Conditioning Repairs

• • • **WPB granted** A-1-a ratings for deliveries of materials needed for repairs to air conditioning and refrigerator equipment. This high rating was granted for breakdowns of blast furnace air conditioning equipment as well as equipment used for food and dairy products handling and meat pack-

ing houses. Provisions have also been made to avert breakdowns and maintain emergency repair service for existing essential equipment. The program is set forth in preference rating order P-216, and ratings assigned under the terms of the order will be available only until June 30.

In addition to A-1-a rating for actual breakdowns of equipment deemed essential for health and safety, the order provides ratings of: A-3 to avert breakdowns for which A-1-a ratings would be available; A-3 in case of breakdown on equipment in plants engaged in filling defense orders as defined in priorities regulation No. 1; A-8 to avert breakdown of equipment in plants on such defense orders; and A-8 for emergency service of all other types of air conditioning and refrigerating equipment except domestic mechanical refrigerators.

The ratings may be applied only to designated Emergency Service Agencies or suppliers authorized to represent a manufacturer, owner, or lessee of such equipment. These agencies must obtain a serial number from WPB by applying on form PD-399. Several critical materials, such as copper, stainless steel, and alloy steel, cannot be obtained with the ratings.

Steel Plates

• • • **Plate consumers** with excessive inventories, according to WPB, will receive no allocations in May. May output is expected to be in excess of 900,000 tons, but because demand continues at least 50 per cent in excess of rising plate production a constant check upon plate inventories is being made.

Construction Supplies

• • • **A supplier of** construction materials for defense housing projects will be permitted to extend preference ratings at any time within three months after permission has been granted to apply it, WPB ruled in amendments to preference rating orders P-19-c, P-19-d and P-55, effective April 20. Each defense housing project is assigned a preference rating and an individual preference rating order is issued for a specific period to the builder to aid in getting the materials needed for construction. Builders may serve the ratings on suppliers authorized to deliver the materials, but since builders often do not apply ratings until shortly before the expiration date, it gives suppliers little time in which to extend the ratings to producers of the needed materials. Today's amendments will give them additional time for this purpose. The builder must apply the rating before expiration.

Rubber Tired Farm Machines

• • • **Return to** steel wheels for farm machinery and equipment was assured by a WPB order which calls for discontinuance on April 30 of rubber tired equipment except for combine harvester-threshers. Production of combines requiring rubber tires must be stopped after July 3. The action was embodied in amendment No. 1 to supplementary order L-26-a.

Hot Water Tanks

• • • **Storage tanks** for hot water heaters of the type used in most homes will be manufactured in only 20, 30 and 40 gal. sizes after May 15 as a result of a WPB simplification schedule issued on Saturday. Schedule No. 9 to order L-42 covers direct fired gas storage water heaters, and eliminates all models requiring more than one flue. The use of metal jackets, as well as brass and copper cold water inlet pipe containing copper or brass is prohibited. Another schedule, No. 8 to the order requires the simplification of vacuum and vapor heating specialties, after June 15.

Export Rulings

• • • **A new method** of assigning preference ratings to export orders was adopted by WPB, superseding all orders for various products when new forms for their export have been drawn. Priorities regulation No. 9 provides that a preference rating assigned under its terms to a product for export may not be applied without an export license or other authorization to export. The rating will be automatically cancelled if the export license is revoked. When a priority rating is assigned on any form approved for use under the terms of the regulation, the rating may be served on a supplier by an endorsement, but must be accompanied by a copy of the export license or statement of authority to export, plus a certificate from BEW or Lend-Lease that a preference rating has been assigned to the order. The rating may be extended by the supplier to sub-suppliers in the same manner as other extendable preference ratings.

Machine Tool Finishes

• • • **Fancy painting** and finishing of metal working machinery by machine tool builders was banned after April 30 by limitation order L-108. The order, effective April 27, provides that only one coat of primer or sealer may be applied to new metal working equipment, no filler may be applied, and not more than two coats of paint, enamel, or lacquer may be used. Any color other than "old machine tool gray" for the final coat is prohibited.

Dairy Machinery Repairs

• • • **WPB amended** preference rating order P-118 to restrict the application of preference ratings by dairy processors to orders for repair, maintenance, and operating materials for use before June 30, when the order expires. The order makes available for this period an A-2 rating for emergency repair materials and an A-3 rating for normal repair, maintenance, and operating materials for plants producing or processing dairy products.

Crown Caps

• • • **The manufacture** of tinplate, terneplate, or black plate into crown caps for beer and other bottled beverages was prohibited last Friday by an amendment to Conservation Order M-104 except to the extent required, after exhausting inventories of shells to make deliveries permitted by General Preference Order M-8-a on cork.

Shells are crown caps to which the cork disc has not yet been added.

The cork order permits deliveries of crowns with cork discs provided that total inventories do not exceed 20 per cent of the crowns used or resold by the purchaser.

The amendment is designed to prevent the manufacture of excessive numbers of crown caps, and a resultant waste of tinplate, terneplate, and black plate, by persons having large inventories of cork. Terms of M-104 order permitted the production of tinplate and terneplate crown caps until May 1 to the extent that cork was available.

The provision banning the manufacture of crown caps made from tinplate or terneplate after May 1 continues in effect.

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Explosives on A-1-c

• • • **Explosives and** explosive equipment have been added to the list of mining machinery and equipment which may be obtained by the use of an A-1-c rating assigned by preference rating order P-56 by WPB on Tuesday. To clear up some questions which have arisen as the result of this amendment, WPB explained that the A-1-c rating is applicable for repair to blasting machines and similar machinery and equipment but that the rating may not be used for obtaining operating supplies such as black powder and dynamite to which the A-8 rating remains applicable.

Mines which do not come under P-56 may use an A-10 rating under the general maintenance and repair order P-100, to get explosives. The amendment does not affect any existing priorities on explosives and explosive equipment nor prevent any mining operator from obtaining explosives in the same way as before the amendment was issued.

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Shoe Shank Steel Limited

Washington

• • • **Restriction** has been requested of the 10 manufacturers of steel for shoe shanks, by WPB's leather and shoe section. The section asked makers to discontinue the manufacture of shoe shank steel except for 18 gage shanks 0.45-in. thick; 21 gage shanks 0.032-in. thick; and 19 gage shanks 0.040-in. thick. The 0.045-in. and 0.032-in. steel is to be 0.50 carbon and the .040-in. is to be low carbon.

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"Priorities" for Carriers

• • • **Priorities, in** effect, have been set up by the Office of Defense Transportation in its order to put over-the-road freight operations on a more efficient basis. The three ODT orders, general orders 3, 4, and 5, set up specific wartime rules for common carriers, contract carriers, and private carriers that go into effect June 1.

Over-hauling of shipping schedules and, in the case of common carriers, outright pooling of facilities, are expected to eliminate less-than-capacity loads, while conservation of tires and equipment will be stressed through establishment of ceilings on overloading and elimination of circuitous hauling routes.

Except for vehicles exempt from the regulations because of the nature of the services in which they are engaged, all trucks after June 1 shall be loaded to capacity on outgoing trips and to at least 75 per cent of capacity on return trips. Not only are common carriers expected to tighten up operation through schedule revisions, but also to pool their facilities wherever necessary to carry out the provisions of the order. They may alternate or stagger schedules; exchange shipments or property; pool shipments or revenues; jointly load or operate trucks; divert shipments, lease equipment, operate joint terminals or pickup or delivery vehicles; establish arrangements with out carriers for the interchange of equipment; and appoint a joint agent to handle or conduct carrier business.

Trucks covered by the three orders will, after June 1, be allowed to load only to the extent of 120 per cent of the rated tire capacity, as determined by ODT scale, and no truck shall be allowed to return to the point of origin empty or only partly loaded unless there are no goods in the possession of any common carrier awaiting transportation in the direction in which the truck would be traveling on its return trip.

Such an order will facilitate to a great extent the movement of materials within the country, especially from one producing center to another, but will become increasingly difficult as demands on the industry increase as truck facilities become reduced. ODT pointed out that in 1941 about 700,000 new trucks were put into service in the United States, while only 150,000 will be available during 1942 and 1943.

U. S. Steel Quarterly Earnings $27,921,534

• • • **Reported net** earnings of the U. S. Steel Corp. for the first quarter ending March 31, were $27,921,534, compared with $20,482,984 for the fourth quarter of 1941 and $36,559,995 for the first quarter of 1941. A quarterly dividend of $1.75 per share on preferred stock and a dividend of $1 a share on common stock was declared at the quarterly meeting. During the first quarter of 1942, shipments of finished steel products totaled 5,136,418 net tons, with average operations of plants at 101.5 per cent of capacity.

Priorities Ahead for Lake Ore Shipments

Cleveland

• • • **A new office** has been created by a committee of Great Lakes vessel operators to obtain the maximum efficiency of lake fleets in the movement of some 88,000,000 gross tons of ore this season. Carl H. Suder will be in charge of the office and it is reported that the WPB has certified to the Office of Defense Transportation that priorities and preferences be given for lake shipment of ore this season.

Enemy Drives SAE From White Sulphur

Detroit

• • • **The continued** presence of enemy diplomats at the Greenbrier in White Sulphur Springs, W. Va., has made it impossible to hold the 1940 Summer Meeting of the Society of Automotive Engineers there as originally planned. This, and emergency war conditions which make it impossible for the railroads to guarantee transportation to any other suitable site, has resulted in a decision by SAE to cancel the summer meeting and substitute a special of the *SAE Journal* and special local or regional meetings for members.

This Week's Priorities and Prices

Export ceilings over all commodities and products sold for export established by maximum export price regulation, effective April 30. (OPA-PM3035)

Lead, antimony, rubber, and other critical materials going into manufacture of storage batteries under conservation program by order L-4-b, effective April 26. (WPB-988)

Aluminum and Magnesium, Inc., Sandusky, Ohio, charged with diversion from primary needs of war program 180,000 lb. of aluminum, by order S-32. Orders S-35 and S-38 were also issued. (WPB-990)

Refrigerator amendment No. 2 to order L-5,, effective April 25, makes clear that low-temperature mechanical refrigerators shall not be considered domestic mechanical refrigerators. (WPB-982)

Priorities regulation No. 9, effective April 25, provides a new method of assigning preference ratings for export orders. Orders P-103-a and P-98-a are revoked. (WPB-985)

Sewing machine output to cease June 15 by order L-98. Curtailed production of sewing machines and attachments in effect until June 15. (WPB-986)

Hot water storage tanks will be made in only three sizes after May 15 as a result of schedule IX to order L-42. Vacuum and vapor heating specialties to be simplified after June 15 by schedule VIII. (WPB-T235)

Magnesium allocation order M-2-b extended until Oct. 31. (WPB-T237)

Bottle cap manufacture restricted for balance of month of April by amendment No. 1 to order M-104. (WPB-T234)

Over-ceiling price granted Harshaw Chemical Co., Cleveland, for sale of 45 tons of dynamite glycerine by amendment No. 1 to revised price schedule 38. (OPA-PM2991)

Tire price increases allowed to cover cost of Government's tire return plan by amendment No. 1 to revised price schedule 63, effective April 25. (OPA-PM3030)

Machine tools for two war orders may be sold over the ceiling price by two manufacturers under amendment Nos. 7 and 8 to revised price schedule 67, effective April 23. (OPA-PM3034)

Nickel scrap controlled completely by order M-6-c, effective April 22. (WPB-966)

Fishing tackle for non-commercial use may not be made of metal, plastics, and cork after May 31, by order L-92. (WPB-976)

Used rail and rail joints will be controlled by WPB, effective April 22, by Order L-88. (WPB-T229)

Extended surface heating subcommittee of plumbing and heating industry advisory committee formed. (WPB-T232)

Preference ratings on individual applications for materials to be used in general manufacturing operations will soon be discontinued as a further step toward putting industry under Production Requirements Plan. (WPB-943)

Refrigerator freeze order, L-5-b, amendment No. 3 effective April 20, clears up three obscure points in original order. Interpretation No. 1 of order L-5 states that refrigerators built for Army, Navy, or Maritime Commission are not covered by the order. (WPB-952). Order P-126 grants high preference ratings for deliveries of materials needed for repairs of refrigeration and air conditioning equipment. (WPB-958)

Metal office furniture order, L-13-a amended (No. 1, effective April 20) to remove restrictions on metal shelving and lockers produced for Army, Navy, and Maritime Commission. (WPB-T219)

Crane and hoisting equipment manufacturers notified that they can continue until July 1 using preference ratings assigned under order P-5-b. (WPB-T220)

Gas cooking stoves are subject to order L-79, covering sales and deliveries of plumbing and heating equipment. (WPB-T221)

Priority violations charged against Anderson & Sons, Westfield, Mass., with respect to aluminum, copper, and stainless steel use; suspension for six months from accepting or delivering such material by order S-19, effective April 20. (WPB-957)

Paint and varnish temporary maximum price regulation 19, effective April 22, fixes 60-day ceilings for manufacturers' sales of such items at April 12 levels. (OPA-PM2992)

Pipe, wire products and galvanized sheet jobbers subcommittee of iron and steel advisory committee formed. (WPB-946)

Metal use survey for first quarter 1942 and anticipated third quarter requirements being made by WPB. Reports made on form PD-275. (WPB-949)

Enameled closures order M-116, issued April 4, amended (No. 1 effective April 20) to postpone effective date. (WPB-952)

• • •

For copies of above announcements address Division of Information, WPB (or OPA), Washington, giving announcement number as shown in parentheses after each paragraph. (For example, **WPB-600** *means announcement 600 issued by the War Production Board.)*

Revisions for the Iron Age Priorities Guide

• • • The following data should be added to THE IRON AGE Priorities Guide published with the issue of March 26 to bring the Guide up to date:

Under "P Orders," page 5, add:

P-19-c, P-19-d, and P-55...Amendment No. 1 to each of these orders permits supplier of material for defense housing construction to extend preference ratings at any time within 3 months after authorization to apply it. (4-20-42)

P-118...Makes available use of A-2 and A-3 ratings for repair and maintenance of plants processing or producing dairy products. Related forms: PD-413 and PD-414. (4-18-42)

P-126...Grants high preference ratings for materials for repairs of air conditioning and refrigeration equipment. Related form: PD-399. (4-20-42)

Under "L Orders," page 12, add:

L-4-b...Supplementary limitation order restricts manufacture of storage batteries after April 30 except in specified capacities and under other provisions. (4-25-42)

L-5-b...Amendment No. 3 covers deliveries of refrigerators to dealers and consumers; sale of refrigerators by one dealer to another; and transference of refrigerators from one warehouse to another. Interpretation No. 1 to order L-5 states that refrigerators built for Navy, Army or Maritime Commission are not covered by order. (4-20-42)

L-26-a...Amendment No. 1 discontinues production of rubber tired farm machinery, except on combine harvester-threshers, after April 30, and discontinues rubber tired combine production after July 31. (4-20-42)

L-31...Amendment to Exhibit A, No. 2 extends restriction on delivery of natural and mixed natural and manufactured gas to consumers in parts of six midwestern states: Iowa, Kansas, Minnesota, Nebraska, Oklahoma, and South Dakota. (4-23-42)

L-78...Amendment No. 1 eases restrictions on production and sale of small fluorescent lighting fixtures, and sets a closing date of May 16 on manufacture of fixtures with a capacity greater than 30 amps. (4-23-42)

L-79...Interpretation considers gas ranges covered by order on sales and deliveries of plumbing and heating equipment. (4-21-42)

L-83...Removes until May 15 restrictions on production of critical industrial machinery. (4-20-42)

L-88...Control of used rail and used rail joints taken by WPB, requiring return of like footage of used rail and same number of used rail joints as received in new replacement rail. (4-22-42)

L-92...Stops production of non-commercial fishing tackle by prohibiting use of metals, plastics, and cork after May 31. Fish hooks may be made after June 1 at a rate of 50 per cent of 1941 production. (4-23-42)

L-98...Limits sewing machine and attachment production until June 15, after which time production must cease. (4-25-42)

Under "M Orders," page 9, add:

M-6-c...Requires segregation of scrap containing more than 0.5 per cent nickel by weight and permits its melting only for authorized uses. Related forms: PD-149, PD-150, PD-151, and PD-394. (4-22-42)

M-21...Amendment No. 3 and extension No. 2 abolishes form PD-73 and requires that all purchase orders for iron or steel bear ratings of A-10 or better after May 15, except as specified. Related form: PD-139. (4-21-42)

M-84...Amendment No. 5 permits extended manufacture of binder twine. (4-22-42)

M-116...Amendment No. 1 postpones effective date of order from April 4 to April 30 on manufacture of enameled closures. (4-20-42)

M-132...Advises sulphur consumers to build up reserve supplies to avoid operation halts by possible transportation tieups. (4-18-42)

M-137...Halts use of benzene or benzol in motor fuel in 30 days. (4-20-42)

OPA's New Order Does Not Affect Present Price Ceilings

Washington

• • • **The overall price** order announced on Tuesday by Price Administrator Leon Henderson does not affect existing schedules. Likewise the OPA order of April 25 establishing blanket price ceilings on products sold for export leaves existing schedules undisturbed. Export prices will be governed by new regulations only if they are not covered by present schedules or if licenses were not issued before April 30. Therefore, the orders do not affect ferrous or non-ferrous metals or metal working machinery since schedules covering these fields have been in effect for varying periods.

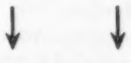
The overall price order followed on the heels of President Roosevelt's anti-inflation message which was sent to Congress on Monday. The order covers nearly all prices charged by retailers, wholesalers, manufacturers and producers of raw materials.

Those commodities covered by temporary 60-day regulations automatically will come within the provisions of the general ceiling regulation upon their expiration unless otherwise treated by separate orders. Approximately 1,900,000 retail outlets are affected.

The order freezes prices at the highest price charged during March, 1942, by each individual seller. The ceiling becomes effective on three different dates. These are: Retail, May 18; retail services, July 1; manufacturers, wholesalers and industrial services, March 11.

All wholesalers and retailers must register with OPA at such time and manner as may be prescribed and they are automatically granted a license which may be withdrawn for price violations.

The regulations specifically exempted domestic ores and their concentrates.



Order Covers Non-Ferrous Castings, Rolled Zinc

Washisgton

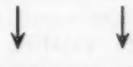
• • • **Maximum price regulations** issued on Tuesday by OPA cover among other products rolled zinc, non-ferrous castings, fluorspar, farm equipment, construction and road maintenance equipment, mixed fertilizer machines and parts, and standard ferro-manganese. Prices on these products become effective on May 11. The prices are frozen as of the following dates:

Oct. 1-15, 1941—Non-ferrous castings, farm equipment, construction and road maintenance equipment, and standard ferro-manganese. (The price of standard ferro-manganese during this period was $120 per ton, Atlantic Seaboard.)

Nov. 29, 1941—Rolled zinc.

Jan. 2, 1942—Fluorspar.

Price schedules were withdrawn as they affected domestic washing and ironing machines; a resale of domestic cooking and heating stoves and ranges; resale of new radio sets and phonographs; new typewriters; plumbing fixtures and domestic electrical appliances.



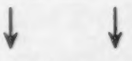
Steel Prices Scrutinized

• • • **All through** the steel and allied industries, price policies have been and are being tightened in strict conformity with government regulations. Steel company legal staffs probably have spent more time on price questions in recent weeks than upon any other single question.

One large producer has mailed refund checks to a number of consumers charged freight under application of emergency basing point provisions. This refund action arose from clarification of proper methods of applying the emergency rates. Instead of the several methods which existed early this year when confusion surrounded the problem, most of the major producers now appear to be computing the emergency rates by using each producing plant, each sales area and a two-year-average of sales.

Curiously, the steel industry has been bothered by several instances of price concessions this year. while not illegal, these concessions are unusual under current market conditions. In one instance, creation of what amounted to a temporarily arbitrary area aroused much comment. Another case involved a large award for a government cantonment.

Price cutting in the competition to get government business has been prevalent among certain steel users and non-integrated processors.



Zinc and Lead Contracts

• • • **Sales contracts** for future delivery of primary slab zinc or primary lead are not invalid merely because the price at which delivery is made depends on some future contingency, OPA rules. The price may not exceed the maximum in effect at time of shipment. This new ruling is covered in amendment 2 to Schedules 69 and 81.

Tungsten Price Extended

• • • **To aid further** in stimulating domestic production of tungsten, Metals Reserve Co. in conjunction with WPB announced April 21 that its domestic price policy of $24 per dry short ton of WO_3 will remain in effect until Dec. 31, 1943. Eligible producers and new producers will be paid that amount f.o.b. cars New York, for domestic concentrates meeting specifications.

Zinc Oxide Prices

• • • **Except for** individual producer voluntary price agreements, no action has been taken by OPA with respect to establishing maximum prices for zinc oxides, it was emphasized April 21, following a meeting several days earlier in New York. Producers have been asked individually to enter into agreements with OPA not to sell at prices above maximums published by OPA on Dec. 16, 1941, and supplemented by a statement issued on March 28, 1942. The ceilings which producers were asked not to exceed are as follows for zinc oxides delivered in bags in carload lots:

Lead-free American process oxide, 7.25c.
Leaded zinc oxides (35% or more lead), 7.00c.
Leaded zinc oxides (less than 35% lead), 7.125c.
Lead-free French process oxides, other than U.S.P., made from slab zinc or secondary metal (including any oxides made partly from slab zinc, partly from secondary metal), 9.50c.

French process U.S.P., oxide, 10.50c.

The price as announced for French process oxides is the maximum for all grades other than U.S.P. and the producers may wish to sell their less select grades at appropriate differentials below the maximum price.

To determine the maximum prices for any other oxides which customarily have sold below the price of lead-free American process oxide, producers should deduct from the "American process" price a differential at least as large as that which prevailed on Oct. 1, 1941.

To the foregoing maximum prices:

(a) Producers have been requested to add no more than ¼c. a pound for less than carload lots;

(b) Producers in California, Oregon and Washington were requested to add no more than ½c. a pound; and

(c) Producers have been asked to add no more than ¼c. a pound for oxides sold in panels.

The maximum prices for less than carload lot sales on the West Coast may be applied f.o.b. plant or warehouse, rather than on a delivered basis. Zinc oxides are used principally in paints.

Machine Tool Firms Aided

• • • **Amendment No. 7** to the price schedule on new machine tools permits Gould & Eberhard, Newark, N. J., to sell 209 shapers made by its subcontractor, Henry & Wright Mfg. Co., Hartford, at higher than the established maximum prices, due to high costs incident to the subcontract. The 24-in. standard shaper which sold for $3,608 on contracts executed prior to Jan. 27 will have maximum price of $4,050.

Under Amendment No. 8 to the schedule, Cleveland Automatic Machine Co., Cleveland, is permitted to sell 104 of its machines made by Sullivan Machinery Co., Claremont, N. H., at approximately $16,548 each, contrasted with the previous official maximum of $15,250 each.

Export Prices Under Ceiling

• • • **Maximum prices** over all commodities and products sold for export were established April 25 by OPA. The new order becomes effective Thursday, April 30. Its provisions apply to all export sales, regardless of whether or not the commodity or product is under an OPA ceiling schedule or regulation, and over-ride all provisions of existing OPA orders that are in conflict with its terms.

An export sale is a sale of any commodity or product for export to any place outside the territorial limits of the United States.

While the new regulation cuts across all outstanding contracts of sale or purchase it does not disturb prices involved in any export made under a validly outstanding export license issued by the Board of Economic Warfare prior to April 30. However, the provisions are applicable to any export license issued after that date.

Briefly, the new order provides that the export price shall be the cost of acquisition by the exporter plus the average premium charged **in the export trade** on a similar transaction during July 1-December 31, 1940, or March 1-April 15, 1942, whichever period yields the lower average premium. In addition, the exporter may add an amount sufficient to compensate him for expenses, such as war risk insurance, consular fees, demurrage charges, and shipping charges. Manufacturers or producers who export directly can similarly add the lower of the two average premiums and the export expenses to their domestic price for the product or commodity exported.

In specifying the "average premium" that may be added to the cost or domestic price, the regulation requires the exporter to give recognition to existing differentials in export premiums charged by different types of exporters, variances in premiums resulting from different size, value, or volume of exports, as well as differentials in premium as among exports to United States territories and possessions, Canada, and the various foreign countries. In no event may more than one premium be added with respect to a particular export.

Fabricated Bar Prices

• • • **OPA, it is said,** is in the process of setting up a price ceiling order for the fabricated concrete bar industry and although nothing definite has yet been decided upon, proposals include a ceiling of $2.40 a 100 lb. base price for concrete bars sold by fabricators. Tentative definition of a fabricator is said to be a person or persons with warehouse stock, facilities for cutting and bending concrete bars, and the personnel for performing engineering work. If such a proposal goes through, it would result in many cases in a reduction in price since some fabricators have been charging $2.50 a 100 lb. up to and exceeding $2.60 a 100 lb. Steel mills, however, have been quoting a maximum base price of $2.15 a 100 lb. since they are controlled by Price Schedule 6 which placed ceiling prices on the iron and steel industry.

According to tentative discussion, if and when a price ceiling is placed on the fabricated concrete bar industry, steel mills selling concrete bars through their warehouses, which can qualify as a fabricator under the impending rule, may be able to charge the fabricators' ceiling price instead of the mill price governed under Price Schedule 6. Bars sold off the mill would still be subject to Schedule 6.

Informed sources say there is no way of determining what the ultimate fabricated concrete bar ceiling price will be but $2.40 a 100 lb. seems to be the consensus of both individual members of the industry as well as OPA investigators. Due to the strong attempt of mills to obtain A-1-a business in order to keep finishing mill units thoroughly engaged, actual price cutting in the concrete bar business might materialize to such an extent that steel mills would quote $2.15 a 100 lb. or less—as has been done in one or two instances already—even though sold through warehouses. Such a procedure, if it occurred, would undoubtedly force some fabricators to sell under any price ceiling which might be established for their industry. Obviously lower rated tonnage would be sold at the ceiling price.

Advance in Screen Cloth

• • • **An increase** of about 5 per cent in manufacturers' prices for steel screen cloth was permitted by an amendment last week to Revised Price Schedule No. 6, Iron and Steel Products. Maximum prices are allowed in excess of the April 16, 1941, levels, on various grades of steel screen cloth, including 12 mesh painted steel screen cloth, and 14 and 16 mesh galvanized steel screen cloth. OPA said higher prices were proper since a substantial portion of the total output of steel screen cloth is produced by companies which are marginal in their overall picture and unable to operate under the ceiling prices.

Foundrymen Set War Goal

(Concluded from page 55)

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[33] "Correlation and Utilization of New Data on Flow Resistance and Heat Transfer for Cross Flow of Gases Over Tube Banks," E. D. Grimison, *A.S.M.E. Transactions*, Oct., 1937, Vol. 59, No. 7, pp. 583 to 594.

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[43] "Molal Combustion and Graphical Representation of Stack Losses in Burning Petroleum Fuels," O. F. Campbell, *Oil and Gas Reprint of A.S.M.E.*, Tulsa Meeting, May 14 to 17, 1934.

[44] "Heat Transfer in the Radiant Section of Petroleum Heaters," Lobo and Evans, *Transactions American Institute of Chemical Engineers*, Vol. 35, No. 5, Oct.25, 1939, pp. 743 to 778.

[45] "Effect of Reradiation of Heat Transmission in Furnaces and Through Openings," Hottel and Keller, *A.S.M.E. Transactions*, Dec. 5, 1932.

[46] "The Radiation of Furnace Gases," Hottel and Egbert, *A.S.M.E. Transactions*, May, 1941, Vol. 63, No. 4, pp. 297 to 307.

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[50] "Generation of Steam as a Factor in Modern Refinery Heat Economy," W. W. Kraft, V. Mekler and R. H. Reimenschneider, *Ibid.*

[51] "Regeneration Type Air Heaters for Refinery Use," O. F. Campbell and T. B. Kimball, *Ibid.*

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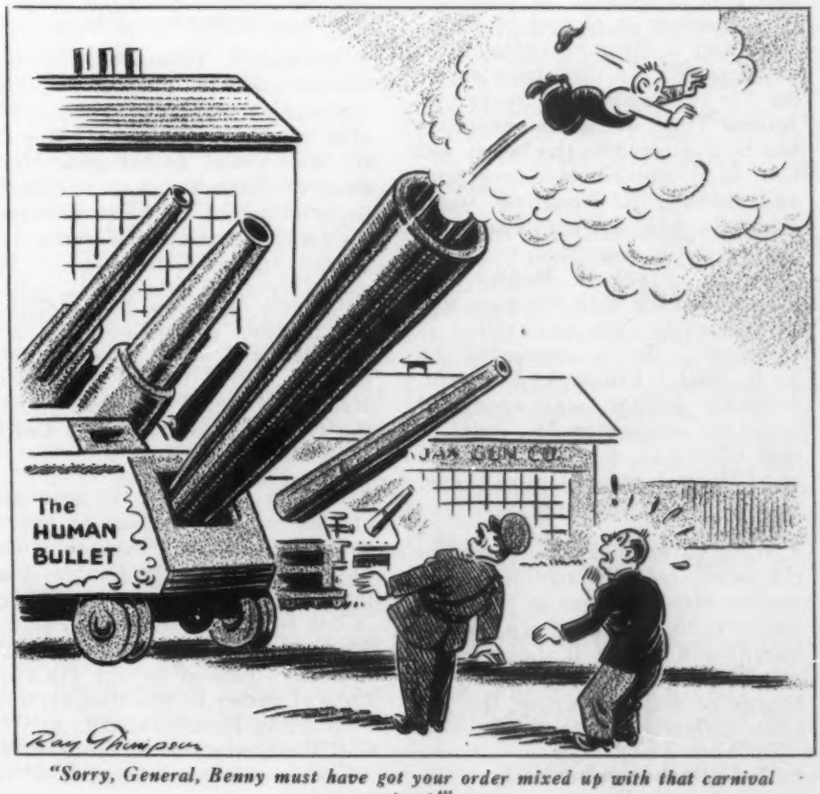
[53] "Combustion," *Industrial Gas Series*, published by the American Gas Association.

Heat Transfer Problems Solved By Alco Calculator

New York

• • • **The Alco Products Division** of American Locomotive Co., 30 Church Street, New York, has made available at cost (25c.) a limited number of "mean temperature difference" calculators in the form of a multiple slide rule to aid in the approximation of heat transfer surfaces when preparing estimates or specifications for heat exchanger equipment. The Alco M.T.D. calculator includes scales for the determination of the logarithmic M.T.D. as well as the correction factors for one, two, three, four and six shell passes. The device is offered as a time saving instrument for solving complex heat transfer problems.



"Sorry, General, Benny must have got your order mixed up with that carnival contract!"

PERSONALS

• **Harry H. Burris** has been elected president of the National Association of Flat Rolled Steel Manufacturers with headquarters at Pittsburgh, to succeed the late A. N. Florra. Mr. Burris, who has been secretary for a number of years, has been connected with the association since 1917 except for the period spent with the U. S. armed forces during World War I.

• **Norman Baughn,** with Cook Paint & Varnish Co. for the past 12 years, has joined American-Marietta Co., Chicago, as a technical specialist in Army and Navy ordnance and Quartermaster Corps paints.

• **Dr. Frank J. Tone** has retired as president of the Carborundum Co., Niagara Falls, N. Y., and has been elected chairman of the board of directors. The new president is **Arthur A. Batts,** long associated with the company, and its secretary since March, 1927. **Charles Knupfer,** formerly vice-president in charge of sales and a member of the board of directors, has been named as senior vice-president and will continue as head of the sales department. **Henry P. Kirchner** has been appointed as executive vice-president in charge of operations and a director, having been vice-president in that same capacity for a number of years. **F. Jerome Tone, Jr.,** sales executive, has been elected to the board and has been named vice-president, and **Edward R. Newcomb,** sales executive, has been also elected as one of the vice-presidents of the company. **Frank H. Manley, Sr.,** whose identity with the company dates back to 1896, has retired as treasurer. He is succeeded by **T. B. Foot. Frank A. Vockrodt,** formerly auditor, was appointed secretary succeeding Mr. Batts in that office and **A. J. D'Arcangelo** and **Gilbert J. Stewart** were named as assistant treasurers.

• **W. A. Givens** has been elected to the newly created position of executive vice-president of the Allegheny Ludlum Steel Corp., Pittsburgh, and **Frank B. Lounsberry** has been made vice-president in charge of manufacturing, the position formerly held by Mr. Givens.

• **W. C. Buchanan** has resigned as president of Allis-Chalmers Mfg. Co., Milwaukee, because of ill health. Mr. Buchanan retains his membership on the board of directors and executive committee of Allis-Chalmers Mfg. Co., a position he has held for several years. **Walter Geist,** formerly vice-president, has been elected executive vice-president, but there will be no election of Mr. Buchanan's successor until after the annual directors' meeting on May 7.

G. T. CHRISTOPHER, president and general manager, Packard Motor Car Co.

• **Norman E. Thompson** has been named assistant general superintendent of the Birmingham Division, Southern District of Republic Steel Corp. At the same time, **John L. Adcock** was promoted to superintendent of blast furnaces and coke plants in the same district.

• **Gordon McMillin** has resigned his position as metallurgist for the Standard Brake Shoe & Foundry Co., Pine Bluff, Ark., and Memphis, Tenn., and has joined the General Steel Castings Corp., Eddystone, Pa.

• **Guy T. Avery,** works manager of the company's plant at Riverdale, Ill., and **W. Sheridan Huss,** sales manager of the Central District, are newly elected members of the board of directors of Acme Steel Co., Chicago. These men fill vacancies caused by the resignations of **James E. MacMurray,** now residing in Pasadena, Cal., and **F. C. Gifford,** who retired from active service a year ago because of ill health.

• **Howard W. Broecker** has been appointed as assistant district manager in the Chicago district for the Copperweld Steel Co., Warren, Ohio. Mr. Broecker was previously connected with the Youngstown Sheet & Tube Co. in its Chicago district and with the Interstate Iron & Steel Co. in the same district.

• **George A. Meyrer** and **Mundy I. Peale** have been elected vice-presidents of Republic Aviation Corp., Farmingdale, N. Y., and will be assigned to the direction of certain expansion activities of the corporation.

• **J. Eugene Jackson,** until recently metallurgical engineer with the Copper Iron & Steel Development Association, Cleveland, has accepted a position as senior industrial analyst with the War Production Board. He is serving in the Copper and Brass Division, Inventory and Requisition Section, Division of Industrial Operations.

• **Robert L. Welborn,** former manager of Lincoln Motor Co., division of Ford Motor Co., has become vice-president in charge of manufacturing of Cleveland Pneumatic Tool Co., Cleveland. In 1917 Mr. Welborn had charge of the tooling job for the first Liberty Motors turned out by the Lincoln Co.

• **Paul Wassmansdorf** has been named advertising manager of the General Electric appliance and merchandise department's plastics division at Pittsfield, Mass. Mr. Wassmansdorf is being transferred from the appliance and merchandise department's advertising division in Bridgeport, Conn., where he has been assistant to H. R. Smith, advertising supervisor for heating devices, fans, clocks and sunlamps.

• **Dean E. McCrory,** attached to the Pittsburgh office of the heavy chemical sales division of the Pennsylvania Salt Mfg. Co. since 1936, has been transferred to the company's executive offices in Philadelphia. **A. H. Clem,** for the past three years district sales-service representative of the Penn Salt Cleaner Division in the Detroit area, has been transferred to the executive offices of the Pennsylvania Salt Mfg. Co., Philadelphia. He will coordinate the activities of the company's Industrial Cleaner Division.

• **J. C. McQuiston** has resigned as secretary-manager of the American Gear Manufacturers' Association after serving 10 years in this capacity. **Newbold C. Goin,** who was formerly sales manager of the gearing division of the Nuttall Works of Westinghouse Electric & Mfg. Co., succeeds Mr. McQuiston. Prior to his official connection with the A.G.M.A., Mr. McQuiston was for more than 30 years general advertising manager of Westinghouse. While identified with Westinghouse he participated in the founding of the A.G.M.A. in 1917. Mr. Goin has a background of sales and service with Westinghouse Electric & Mfg. Co. He is a veteran of World War I, having served 13 months overseas in the Signal Corps, entering as a private and finishing in the capacity of master signal electrician.

• **Arthur Dressel** has been elected vice-president in charge of sales, R. Hoe & Co., Inc., New York, and **Joseph L. Auer** has been named vice-president in charge of production. Mr. Auer has been general works manager since he joined the Hoe organization in 1937.

• **Dr. Paul Martens** has retired as manager of the Metal & Thermit Corp. plant at Carteret, N. J., after having completed 33 years of active service. Prior to his going to Metal & Thermit in 1909, Dr. Martens was engaged as a laboratory technician in New York City for six years. In 1916 he became superintendent of the plant at Carteret, and in 1919 was made works manager.

• **L. J. Parrish,** industrial relations director for the A. O. Smith Corp., Milwaukee, has been selected by the WPB to do confidential coordination work. He is a member of the WPB advisory committee in the Chicago district in the labor division training department.

• **Warren H. Clarke** has been appointed as assistant general manager of the Houde Engineering division of the Houdaille-Hershey Corp., Buffalo, and has resigned as Michigan State director of the War Production Board to take over new duties as successor to the late Frank R. Schubert.

• **H. C. Madsen** has been appointed manager of technical employment and training for the Westinghouse Electric & Mfg. Co., East Pittsburgh. As manager of technical employment and training, Mr. Madsen directs the recruitment and training of college seniors who enter Westinghouse through its Graduate Student Course. He also is responsible for the employment of technical personnel and for the scholarship activities of the company.

• **George G. Raymond, Jr.,** has been elected assistant treasurer of Lyon-Raymond Corp., Greene, N. Y., and is now serving as sales promotion manager, a newly created position devoted to the analyzing of special material handling problems.

• **William D. Reed** has recently been appointed general manager of sales for the Sawhill Mfg. Co., Wheatland, Pa., and will supervise all the sales of tubular products. For the past three years, Mr. Reed had been connected with the Chicago district office of the Republic Steel Corp. and for a number of years prior to that time was affiliated with the Pipe Sales division of the Republic Steel Corp. in Cleveland and in Youngstown.

• **J. A. Riley,** New York district manager of the Marion Steam Shovel Co., Marion, Ohio, has been appointed export manager with headquarters at the Graybar Building, New York. He will continue as district manager.

• **G. Lee Camp,** member of the board of directors and co-general manager of the Organic Chemicals division, Monsanto Chemical Co., St. Louis, will retire on June 30 after 41 years in the chemical industry. Mr. Camp joined Monsanto 12 years ago. Previous to his connection with Monsanto he was with Dow Chemical Co. for 28 years, having started in 1901 as a laborer and attained the position of general sales manager in charge of sales and distribution of all Dow products in 1929.

• **M. Rhine** has been appointed manager of the industrial department of the General Electric Pacific District. In his new capacity, Mr. Rhine will be responsible for G-E's Industrial Department activities on the West Coast with the exception of Washington and Oregon.

OBITUARY . . .

• **Louis J. Dolle,** former chairman of the board of the Lodge & Shipley Machine Tool Co., Cincinnati, died April 21 following a year's illness. He was 80 years old.

• **J. Thomas Hay,** one of the pioneer metallurgists in iron and steel, died April 12, aged 59 years. Mr. Hay started with the United Steel Co. in 1901. He continued his metallurgical activities when Central Steel and United Alloy merged to become Central Alloy Steel Corp., one of the units assembled in 1930 to form Republic Steel Corp.

• **James A. Cranston,** 80, who retired in 1938 as commercial vice-president of the General Electric Co., Schenectady, after 49 years of active service on the Pacific coast, died April 15 at his home in San Francisco. Mr. Cranston first began selling electricity and electrical equipment in the spring of 1889 for the old Northwest Thomson-Houston Company at St. Paul, Minn. Shortly after the Thomson-Houston Co. became a part of the General Electric Co. in 1892, Mr. Cranston became manager of the Northwest territory with headquarters in Portland, Oregon.

• **William Jackson,** aged 74 years, consulting engineer of the American Bridge Co., Pittsburgh, for 35 years, died April 22 at his home in Pittsburgh. Mr. Jackson had retired 16 years ago because of ill health.

• **John C. Wattleworth,** vice-president of the Cleveland Automatic Machine Co., Cleveland, died April 19, aged 48 years. Mr. Wattleworth had been vice-president of the company for the past six years. He was a graduate of Case School of Applied Science, from which he received a bachelor's degree in mechanical engineering in 1920. He subsequently taught mechanical engineering at Case until 1932, when he resigned to become general manager of the Vlchek Tool Co.

• **William R. Tomlinson,** manager of the Hartford drop forge division of the Capewell Mfg. Co., West Hartford, Conn., died April 21. Formerly he was works manager of the J. H. Williams Co., Buffalo.

MACHINE TOOLS

. . . SALES, INQUIRIES AND MARKET NEWS

WPB Will Probably Drop Tool Allocation Plan

Cleveland

• • • **The method** of allocating machine tools by means of a stamp plan which was being considered by the WPB machine tool section apparently will be abandoned. Although the scheme was fundamentally sound, apparently the extensive staff required to do the necessary detail work caused authorities to abandon it, rather than waste time experimenting with it some time after July 1.

This becomes the second major scheme for allocating machine tools that has been considered unofficially, and then discarded without any official notice. It will be recalled (see THE IRON AGE, Feb. 12) that machine tool allocations had originally been slated for March 1, then postponed to April 1, only to have the plan subsequently abandoned.

At present, the industry is getting along fairly well with its "freezing" periods, which are unaffected by changes in the "urgency standing" list and in priorities. The urgency standing list now has over 2000 companies on it, and the positions of many of these are being shifted frequently.

American Stove Co. and Perfection Stove Co. may soon be in the market for machine tools. Moreover, it is believed that the Hunkin-Conkey Construction Co. may begin buying within 60 days.

Stripped Machines Planned

Chicago

• • • **The new Gisholt** "war machines" should be good news to the entire war program which needs large size turret lathes most urgently. These machines will be produced at a remarkably fast rate because Gisholt is making them on facilities available or readily obtainable. Tools and attachments of the most common types are provided. Although these are war machines in the sense that they have been stripped enough to permit volume production, they are definitely machines which will have a wide application—being capable of handling about 90 per cent of the jobs performed on corresponding standard models; and they are being built with materials that will provide a life that should last well beyond the war.

Gisholt has undertaken the manufacture of the two sizes of modified turret lathes at the Government's request to ease the shortage on larger saddle type turret lathes. It has done an exceptionally rapid job of getting ready for production within a few months and it is understood that actual production may be under way by the time this appears.

Orders Still Pour In

Cincinnati

• • • Although an unusual flurry of orders for new tools was reported in this area during the month of March, local manufacturers indicate there has been little let up so far during the present month. As a result of the heavy influx of orders, further pressure for expansion of production facilities is being applied, and manufacturers continue to seek ways and means of satisfying the heavy demand. Plant facilities have been expanded and others are being expanded at the present time, but in addition to that, rearrangement of present production floors has been found feasible. Space between machines has been cut down in many instances, so that room for new production equipment was provided. Subcontracting, of course, is being widely used. Most plants are operating on a virtual 24-hr. schedule, although it is still difficult to get sufficient employees to fill third shifts.

NON-FERROUS METALS

. . . MARKET ACTIVITIES AND PRICE TRENDS

40,000 Tons of Silver Transferred to WPB

• • • **The Defense Plant Corp.** has transferred to WPB approximately 40,000 tons of silver which will be used instead of copper in fabricating bus bars. Concern by Defense Plant Corp. as to who would be responsible if the bars were stolen had prevented transfer until last Saturday. It is thought that Donald M. Nelson's rather practical query may have been responsible for the action. He is said to have asked who could steal a "hot" bus bar.

During discussion of the transfer Secretary Morgenthau revealed that the Treasury was preparing to recommend legislation to make newly mined silver available to industrial users at the world market price, currently 35⅛c. an ounce. While this proposal has been made before, the Secretary's statement that this would be a good time to strike all silver legislation off the books is considered significant because of the tight situation now prevailing in the silver market. Foreign silver is not coming in fast enough, and action of this nature would ease the market, probably preventing a sharp price rise.

Zinc output during the first quarter of this year was 17 per cent ahead of the same period of 1941, Howard I. Young, president of the American Zinc Institute, told members gathered in St. Louis for the 24th annual convention. No war production has been held up by lack of zinc, he added, and 1942 production is expected to total about 1,000,000 tons.

Final action on zinc allocation may be expected shortly, according to WPB's zinc unit. Amended order M-11 will be supplanted by complete allocation, which will require the user to obtain an allocation certificate from WPB. Under the proposed order dealers cannot deliver more than 20 tons a month to a single customer; and remelters must file application by June 15 if they wish to produce after July 1.

A new retort furnace block has been brought into operation at the Fairmount City, Ill., plant of the American Zinc, Lead & Smelting Co., which will produce from 6000 to 7000 tons of slab zinc annually. Construction of American Zinc's electrolytic unit is moving on schedule and should be in production the latter part of the third quarter or the early part of the fourth quarter of this year.

Charged with priority violations and diversion of materials, Anderson & Sons, Westfield, Mass., have been prohibited by WPB from accepting or delivering any aluminum, copper, or stainless steel for six months. The company, which manufactured etched and lithographed metal products, is said to have shipped 38,926 lb. of aluminum for non-defense uses between March 22 and Nov. 1, 1941. It is also charged with misrepresentation in obtaining preference rating certificates for aluminum, brass, steel, and other materials.

Non-Ferrous Prices

(Cents per lb. for early delivery)

Copper, Electrolytic[1]	12.00
Copper, Lake	12.00
Tin, Straits, New York	52.00
Zinc, East St. Louis[2]	8.25
Lead, St. Louis[3]	6.35

[1] Mine producers' quotations only, delivered Conn. Valley. Deduct ¼c. for approximate New York delivery price. [2] Add 0.39c. for New York delivery. [3] Add 0.15c. for New York delivery.

Miscellaneous Non-Ferrous Prices

ALUMINUM, delivered: virgin, 99 per cent plus, 15c.-16c. a lb.; No. 12 remelt No. 2, standard, 14.50c. a lb. NICKEL electrolytic, 35c.-36c. a lb. base refinery, lots of 2 tons or more. ANTIMONY, prompt; Asiatic, nominal, New York; American, 14.50c. a lb., f.o.b. smelter. QUICKSILVER, $197 to $199 per 76 lb. flask, f.o.b. shipping point. BRASS INGOTS, commercial 85-5-5-5, 13.25c. a lb.

SCRAP

. . . MARKET ACTIVITIES AND QUOTATION TRENDS

Overgrading Hit in Newest Amendment To Price Schedule

• • • **Developments** affecting scrap iron and steel were numerous over the past week. The price schedule was readjusted to narrow the differential between No. 2 dealer bundles and bundles made exclusively of tin can scrap. At the same time OPA took a slap at overgrading. The WPB, dissatisfied with the rate at which scrap is moving to mills, threatened direct government buying and handling of all materials in auto graveyards.

Bundles consisting exclusively of tin coated material are placed at $4 per gross ton below the price of No. 2 dealers' bundles, according to amendment No. 3 to Revised Price Schedule 4, issued Tuesday by OPA. Bundles partially composed of tin coated material, now outlawed by WPB under order M-24-b, remain at $8 per ton under No. 2 dealers' bundles, in case special circumstances necessitate sales of such material.

OPA pointed out that the $4 differential will aid consumers who can use such material. American Smelting & Refining Co. can use tin can bundles as a substitute for black bundles. Some steel companies are able to use bundles of tin coated material if they know the amount contained.

The amendment, effective April 28, also adds a new requirement to the schedule with regard to rail or vessel shipping notices, which must contain date of shipment, number and initial of car or name of vessel, consumer's and/or broker's purchase order number, the specific grade or grades shipped, and signature of shipper or his duly authorized representative.

Regulations on mixed shipments of scrap have been stiffened sharply. The amendment withdraws the previous privilege under which consumers could authorize a mixed shipment. The inclusion in one vehicle of more than one grade of scrap puts the shipment in the classification of unprepared scrap, and requires that it be priced at $2.50 per gross ton below the maximum price applicable to the lowest priced grade in the shipment.

From Buffalo and Pittsburgh come reports that WPB has threatened drastic action if auto wrecking is not speeded up, and has again pointed out that wreckers are confronted with possible requisitioning of their yards. All purchases must be completed by May 4 and all scrap delivered to steel mills by June 6.

NEW SYSTEM FOR PLANT SCRAP: Every machine tool in the shops of Wright Aeronautical Corp. is marked with a "V," colored according to the type of metal scrap it produces. Salvage collectors wheel containers, also marked with colored "V's," up and down the factory aisles collecting shavings and chips only from the machine bearing a card on which the colors of the "V" match the colors of the "V" painted on the container. This segregation of salvaged metal makes it possible to reclaim thousands of tons of steel, aluminum, magnesium and other vital metals for the war effort.

WPB has assumed control over all used rail and joints. Limitation order L-88, effective April 22, prohibits any person from selling, transferring or otherwise disposing of relayers or rerollers without authorization.

Order M-6-c, issued by J. S. Knowlson, Director of Industry Operations, requires segregation by all persons of scrap containing more than one-half of one per cent nickel by weight and permits its melting only for authorized uses. Deliveries of nickel scrap may be made to a scrap dealer, but he may, in turn, deliver only under these circumstances:

To a melter who is currently receiving allocations of nickel, for use in products for which the allocation is made.

To a melter who is not receiving allocations of nickel, but who has orders bearing ratings higher than A-2 which call for nickel.

Persons other than melters are restricted to a 30-day accumulation of nickel scrap, unless the nickel content is less than 100 lb.

Buying, Selling of Scrap By Government Threatened

Pittsburgh

• • • **Auto graveyard** owners throughout the country have been warned by WPB representatives that the wrecking program has not been proceeding satisfactorily. At the same time scrap dealers were instructed to see that the entire contents of every auto graveyard in their region is purchased prior to Monday, May 4, and that all contents except a small inventory of loose, salable parts are moved out of the graveyards 60 days after date of purchase.

Auto graveyard owners were told again that if fair offers are rejected the government will, after investigation, requisition the entire yard including parts. Off-the-record comment seems to indicate that the current warnings will probably be the last ones made on this subject to both wreckers and dealers.

Dealers in auto scrap were told that if it is impossible for them to move tonnage of scrap at a rate necessary to fill the needs of the present emergency, the government will resort to direct buying and handling.

Some auto graveyard operators, when told to sell their entire collections at once, reiterated that a labor shortage exists for cutting up the material and that cars cut up are in many instances being replaced almost as rapidly as shipments are made. In one yard, 350 cars were cut up in three weeks but the owner had taken in 150 other cars thus showing a net loss of only 150 cars on his inventory.

Wrecking Projects Soon Will Begin Yielding Scrap

New York

• • • **Normally one** of the nation's large scrap producing areas, this district will soon make important contributions to the scrap cause. The various BIC divisions have located large projects and are seeking to clear titles speedily.

In addition to wrecking of the defunct New York, Westchester &

Boston Railroad (contract awarded to Lipsett Wrecking & Salvage Co., Brooklyn), plans for demolishing the Second Avenue Elevated line are being pushed hard. Red tape preventing wrecking of the Chestnut Street incline in Brooklyn, unused since 1917, is bejng attacked by the Special Projects Section of BIC. The ill-fated liner Normandie may be scrapped.

OPA and Pittsburgh Steel Sign Consent Decree

Pittsburgh

• • • **In a consent decree** resulting in a permanent injunction restraining Pittsburgh Steel Co. from further violations of OPA price scrap regulations, the company admitted the allegations in the government complaint but stipulated in the agreement, signed by both sides, that the violations were not willful.

The complaint charged the steel company generally with paying sorted scrap prices for unsorted material. The company assured the government it had not intentionally violated the price schedules.

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COATESVILLE, PA.—A two weeks' drive here has uncovered a pile of scrap said to be roughly equivalent to 30 lb. for each of the 15,000 inhabitants of Coatesville. Commenting on the success of the campaign, Robert M. Wolcott, president of Lukens Steel, said: "If every community in the United States could duplicate what Coatesville has done in these two weeks the steel mills of America could operate at full capacity for the next year." Lukens cooperated in the drive by furnishing burners to break up unwieldy pieces.

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PITTSBURGH — In a few instances some steel plants are able to lay down a small amount of scrap for the future. An extra effort is being made to "get scrap while the getting is good" in order to have some relief over next fall and winter when production will be pushed to the utmost and when additional steel making units will have been brought in.

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CLEVELAND—The situation continues slightly improved, although allocations are still being made to hard-pressed foundries and mills. Several installations of briquetting equipment are likely to be made in this area soon to handle the increased amount of turnings. The less favorable situation noted at Youngstown, Warren and nearby areas continues. This week Republic has taken off one of its eight open hearths at Warren, and it is likely that another one will be down before the end of the week for lack of scrap. The Ordnance Department and various units of WPB are expected to take a more aggressive part in scrap collection.

PHILADELPHIA — Eighty thousand tons of auto graveyard scrap in the Eastern Pennsylvania area is slated for delivery to dealers by July 4, in a drive started this week by the Bureau of Industrial Conservation of the WPB.

W. T. Hoyt, regional representative of the auto graveyard section, addressed letters to all scrap dealers and graveyard owners in Eastern Pennsylvania, New Jersey and Delaware, informing them that they had until May 4 to complete negotiations for sale of the metal.

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BOSTON—Harry Cohen & Co., Roxbury district, was high bidder for 831 tons of street exposed Boston Elevated Railroad rails and 241 tons stored in city yards. The bid was $14,503. All bids were subject to delivery to American Steel & Wire Co., Worcester. Meanwhile, New Haven, Conn., asked bids on 326 tons of street railway rails; Turner's Falls, Mass., on a 566-ton suspension bridge.

•

CHICAGO—Since it has been learned that OPA may hail more local steel mills and their scrap suppliers into court to force compliance with government regulations, the trade is wondering who is likely to feel the axe. OPA investigators have been in certain mills in the past few weeks, but whether this is routine investigation or the preliminary to court action is not known.

SCRAP PRICES

(All the prices given below are per gross tons and are basing point prices from which shipping point prices and consumer's delivered prices are to be computed)

IRON AND STEEL (OTHER THAN RAILROAD) SCRAP

	BASIC OPEN HEARTH GRADES (No. 1 Heavy Melting; No. 1 Hydr. Compressed Black Sheets; No. 2 Heavy Melting; Dealers' No. 1 Bundles; Dealers' No. 2 Bundles; No. 1 Busheling)	BASIC OPEN HEARTH GRADES	BLAST FURNACE GRADES (Mixed Borings and Turnings; Shoveling Turnings; No. 2 Busheling; Cast Iron Borings)	ELECTRIC FURNACE, ACID OPEN HEARTH AND FOUNDRY GRADES										
				Low Phos.			Heavy Structural and Plate			Cut Auto. Steel Scrap			Alloy free Low Phos. and Sulphur Turnings	Heavy Axle and Forge Turn. First Cut	Electric Furnace Bundles
		Machine Shop Turnings		Billet, Bloom, Forge Crops	Bar Crops and Smaller	Punchings and Plate	3 ft. and Under	2 ft. and Under	1 ft. and Under	3 ft. and Under	2 ft. and Under	1 ft. and Under			
Pittsburgh, Brackenridge, Butler, Monessen, Midland, Johnstown, Sharon, Canton, Steubenville, Warren, Youngstown, Weirton	$20.00	$16.00	$16.00	$25.00	$22.50	$22.50	$21.00	$21.50	$22.00	$20.00	$20.50	$21.00	$18.00	$19.50	$21.00
Cleveland, Middletown, Cincinnati, Portsmouth	19.50	15.50	15.50	24.50	22.00	22.00	20.50	21.00	21.50	19.50	20.00	20.50	17.50	19.00	20.50
Chicago, Claymont, Coatesville, Conshohocken, Harrisburg, Phoenixville, Sparrows Pt.	18.75	14.75	14.75	23.75	21.25	21.25	19.75	20.25	20.75	18.75	19.25	19.75	16.75	18.25	19.75
Ashland, Ky.	19.50	15.50	15.50	24.50	22.00	22.00	20.50	21.00	21.50	19.50	20.00	20.50	17.50	19.00	20.50
Buffalo, N. Y.	19.25	15.25	15.25	24.25	21.75	21.75	20.25	20.75	21.25	19.25	19.75	20.25	17.25	18.75	20.25
Bethlehem, Pa.; Kokomo, Ind.	18.25	14.25	14.25	23.25	20.75	20.75	19.25	19.75	20.25	18.25	18.75	19.25	16.25	17.75	19.25
Duluth, Minn.	18.00	14.00	14.00	23.00	20.50	20.50	19.00	19.50	20.00	18.00	18.50	19.00	16.00	17.50	19.00
Detroit, Mich.	17.85	13.85	13.85	22.85	20.35	20.35	18.85	19.35	19.85	17.85	18.35	18.85	15.85	17.35	18.85
Toledo, Ohio	.....	13.85	13.85	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
St. Louis, Mo.	17.50	13.50	13.50	22.50	20.00	20.00	18.50	19.00	19.50	17.50	18.00	18.50	15.50	17.00	18.50
Atlanta, Ga.; Alabama City, Ala.; Birmingham, Los Angeles; Pittsburg, Cal.; San Francisco	17.00	13.00	13.00	22.00	19.50	19.50	18.00	18.50	19.00	17.00	17.50	18.00	15.00	16.50	18.00
Minnequa, Colo.	16.50	12.50	12.50	21.50	19.00	19.00	17.50	18.00	18.50	16.50	17.00	17.50	14.50	16.00	17.50
Seattle, Wash.	14.50	10.50	10.50	19.50	17.00	17.00	15.50	16.00	16.50	14.50	15.00	15.50	12.50	14.00	15.50
Portland, Ore.	.....	.....	.....	.....	15.50	15.50	14.00	14.50	15.00	13.00	13.50	14.00	11.00	12.50	14.00

BUNDLES consisting exclusively of tin coated material and compressed into charging box size, are $4 per gross ton below No. 2 dealers' bundles. Bundles containing tin coated material but not composed exclusively of such material (outlawed by order M1-24-b) are $8 below No. 2 dealers' bundles.

PITTSBURGH basing point includes switching districts of Bessemer, Homestead, Duquesne, Munhall and McKeesport. Cincinnati basing point includes Newport, Ky., switching district. St. Louis includes switching districts of Granite City, East St. Louis, Madison, Ill. San Francisco includes switching districts of S. San Francisco, Niles and Oakland, Cal.

MAXIMUM prices of inferior grades shall continue to bear same differential below corresponding grades as existed during the period Sept. 1, 1940, to Jan. 31, 1941. Superior grades cannot be sold at a premium without approval of OPA. Special preparation charges in excess of the above prices are banned. Whenever any electric furnace or foundry grades are purchased for open hearth or blast furnace use, prices may not exceed the prices above for the corresponding open hearth grades.

MAXIMUM SHIPPING POINT PRICE—Where shipment is by rail or vessel, or by combination of rail and vessel, the scrap is at its shipping point when placed f.o.b. railroad car or f.a.s. vessel. In such cases, the maximum shipping point prices shall be: (a) For shipping points located within a basing point, the price listed in the table above for the scrap at the basing point in which the shipping point is located, minus the lowest established switching charge for scrap within the basing point and (b) for shipping points located outside the basing point, the price in table above at the most favorable basing point minus the lowest transportation charge by rail or water or combination thereof. Published dock charges prevail, or if unpublished 75c. per ton must be included as part of the deduction.* Shipping by motor vehicle: The scrap is at its shipping point when loaded. For shipping points located within basing points take price listed in table minus lowest switching charge. If located outside a basing point, the price at the most favorable basing point minus lowest established charge for transporting by common carrier. If no established transportation rate exists, the customary costs are deducted. Published dock charges prevail. If unpublished include 75c.* For exceptions see official order.

*At Memphis deduct 50c.; Great Lakes ports $1; New England $1.25.

REMOTE SCRAP: Defined as all grades of scrap listed in table above located in North Dakota, South Dakota, Florida, Montana, Idaho, Wyoming, Nevada, Arizona, New Mexico, Texas, Oklahoma, Oregon and Utah. The delivered price of remote scrap may exceed by more than $1, but not more than $5, the price at the basing point nearest the consumer's plant, provided detailed statement under oath is furnished OPA. Where delivered price would exceed by more than $5 the price at basing point nearest consumer, user must apply to OPA for permission to absorb the additional charges. For exceptions see official order.

UNPREPARED SCRAP: The maximum prices established hereinabove are maximum prices for prepared scrap. For unprepared scrap, maximum prices shall be $2.50 less than the maximum prices for the corresponding grade or grades of prepared scrap. In no case, however, shall electric furnace and foundry grades be used as the "corresponding grade or grades of prepared scrap." Converter may charge $2.50 per ton on consumer-owned unprepared remote scrap (see order).

Where more than one grade of scrap is included in a shipment, the shipment is to be classified as unprepared scrap and shall be priced at $2.50 per gross ton below the maximum price applicable to the lowest grade in the shipment.

Where scrap is to undergo preparation prior to its arrival at the point of delivery, such scrap is not at its shipping point, as that phrase is defined above, until after preparation has been completed.

CAST IRON BORINGS: (No more than 0.5 per cent oil content; for chemical use), add $5 to price of cast iron borings.

UNPREPARED CAST IRON SCRAP—Except for heavy breakable cast, unprepared scrap is given a price ceiling of $2.50 per ton less than the maximum prices for the corresponding grade of prepared cast iron scrap. Where scrap is to undergo preparation prior to arrival at the point of delivery, such scrap is not considered at shipping point until preparation is completed.

Consumers of cast scrap may pay the shipping point price plus established charge for transporting the scrap to their plants. In the case of deliveries by truck, the cast scrap buyer must obtain from the seller a certification, made out to OPA, of the shipping point, transportation charges and details of the sale.

RAILROAD SCRAP

(Per gross ton, delivered consumers' plants located on line.)

	No. 1 RR Heavy Melting	Scrap Rails	Rails for Rerolling	Scrap Rails 3 ft. and Under	Scrap Rails 2 ft. and Under	Scrap Rails 18 in. and Under
Cleveland, Cincinnati, Ashland, Portsmouth, Middletown	$20.50	$21.50	$23.00	$23.50	$23.75	$24.00
Canton, Pittsburgh, Sharon, Steubenville, Wheeling, Youngstown	21.00	22.00	23.50	24.00	24.25	24.50
Chicago, Philadelphia, Sparrows Pt., Wilmington,	19.75	20.75	22.25	22.75	23.00	23.25
Birmingham, Los Angeles, San Francisco	18.00	19.00	20.50	21.00	21.25	21.50
Buffalo	20.25	21.25	22.75	23.25	23.50	23.75
Detroit	18.85	19.85	21.35	21.85	22.10	22.35
Duluth	19.00	20.00	21.50	22.00	22.25	22.50
Kansas City, Mo.	17.00	18.00	19.50	20.00	20.25	20.50
Kokomo, Ind.	19.25	20.25	21.75	22.25	22.50	22.75
Seattle	15.50	16.50	18.00	18.50	18.75	19.00
St. Louis	18.50	19.50	21.00	21.50	21.75	22.00

CAST IRON SCRAP

Other Than Railroad Scrap

	Group A	Group B	Group C
No. 1 machinery cast, drop broken, 150 lbs.			
No. 1 cupola cast	$18.00	$19.00	$20.00
and under	18.00	19.00	20.00
Clean auto cast	18.00	19.00	20.00
Unstripped motor blocks	17.50	18.50	19.50
Stove Plate	17.00	18.00	19.00
Heavy Breakable Cast	15.50	16.50	17.50
Charging box size cast	17.00	18.00	19.00
Misc. Malleable	20.00	21.00	22.00

Group A includes the states of Montana, Idaho, Wyoming, Nevada, Utah, Arizona and New Mexico.

Group B includes the states of North Dakota, South Dakota, Nebraska, Colorado, Kansas, Oklahoma, Texas and Florida.

Group C: States not named in A and B; switch district of Kansas City, Kan., Mo.

. . . Comparison of Prices

(Advances Over Past Week in **Heavy Type;** Declines in *Italics.* Prices Are F.O.B. Major Basing Points)

Flat Rolled Steel: (Cents Per Lb.)	Apr. 28, 1942	Apr. 21, 1942	Mar. 31, 1942	Apr. 29, 1941
Hot rolled sheets	2.10	2.10	2.10	2.10
Cold rolled sheets	3.05	3.05	3.05	3.05
Galvanized sheets (24 ga.)	3.50	3.50	3.50	3.50
Hot rolled strip	2.10	2.10	2.10	2.10
Cold rolled strip	2.80	2.80	2.80	2.80
Plates	2.10	2.10	2.10	2.10
Stain's c.r. strip (No. 302)	28.00	28.00	28.00	28.00
Tin and Terne Plate: (Dollars Per Base Box)				
Tin plate	$5.00	$5.00	$5.00	$5.00
Manufacturing ternes	4.30	4.30	4.30	4.30
Bars and Shapes: (Cents Per Lb.)				
Merchant bars	2.15	2.15	2.15	2.15
Cold finished bars	2.65	2.65	2.65	2.65
Alloy bars	2.70	2.70	2.70	2.70
Structural shapes	2.10	2.10	2.10	2.10
Stainless bars (No. 302)	24.00	24.00	24.00	24.00
Wire and Wire Products: (Cents Per Lb.)				
Plain wire	2.60	2.60	2.60	2.60
Wire nails	2.55	2.55	2.55	2.55
Rails: (Dollars Per Gross Ton)				
Heavy rails	$40.00	$40.00	$40.00	$40.00
Light rails	40.00	40.00	40.00	40.00
Semi-Finished Steel: (Dollars Per Gross Ton)				
Rerolling billets	$34.00	$34.00	$34.00	$34.00
Sheet bars	34.00	34.00	34.00	34.00
Slabs	34.00	34.00	34.00	34.00
Forging billets	40.00	40.00	40.00	40.00
Alloy blooms, billets, slabs	54.00	54.00	54.00	54.00
Wire Rods and Skelp: (Cents Per Lb.)				
Wire rods	2.00	2.00	2.00	2.00
Skelp (grvd)	1.90	1.90	1.90	1.90

Pig Iron: (Per Gross Ton)	Apr. 28, 1942	Apr. 21, 1942	Mar. 31, 1942	Apr. 29, 1941
No. 2 fdy., Philadelphia	$25.84	$25.84	$25.84	$25.84
No. 2, Valley furnace	24.00	24.00	24.00	24.00
No. 2, Southern Cin'ti	24.06	24.06	24.06	24.06
No. 2, Birmingham	20.38	20.38	20.38	20.38
No. 2, foundry, Chicago†	24.00	24.00	24.00	24.00
Basic, del'd eastern Pa.	25.34	25.34	25.34	25.34
Basic, Valley furnace	23.50	23.50	23.50	23.50
Malleable, Chicago†	24.00	24.00	24.00	24.00
Malleable, Valley	24.00	24.00	24.00	24.00
L. S. charcoal, Chicago	31.34	31.34	31.34	30.34
Ferromanganese‡	120.00	120.00	120.00	120.00

†The switching charge for delivery to foundries in the Chicago district is 60c. per ton.
‡For carlots at seaboard.

Scrap: (Per Gross Ton)				
Heavy melting steel, P'gh.	$20.00	$20.00	$20.00	$20.00
Heavy melt'g steel, Phila.	18.75	18.75	18.75	18.75
Heavy melt'g steel, Ch'go	**18.75**	**18.75**	**18.75**	**18.75**
No. 1 hy. comp. sheet, Det.	17.85	17.85	18.75	....
Low phos. plate, Youngs'n	23.00	23.00	23.00	....
No. 1 cast, Pittsburgh	22.00	22.00	22.00	23.25
No. 1 cast, Philadelphia	24.00	24.00	24.00	24.00
No. 1 cast, Ch'go*	21.00	21.00	21.00	22.60

*Changed to gross ton basis April 3, 1941.

Coke, Connellsville: (Per Net Ton at Oven)				
Furnace coke, prompt	$6.00	$6.00	$6.00	$5.625
Foundry coke, prompt	6.875	6.875	6.875	6.25

Non-Ferrous Metals: (Cents per Lb. to Large Buyers)				
Copper, electro., Conn.*	12.00	12.00	12.00	12.00
Copper, Lake, New York	12.00	12.00	12.00	12.00
Tin (Straits), New York	52.00	52.00	52.00	51.75
Zinc, East St. Louis	8.25	8.25	8.25	7.25
Lead, St. Louis	6.35	6.35	6.35	5.70
Antimony (Asiatic), N. Y.	16.50	16.50	16.50	16.50

*Mine producers only.

The various basing points for finished and semi-finished steel are listed in the detailed price tables, pages 116 to 124 herein.
On export business there are frequent variations from the above prices. Also in domestic business, there is at times a range of prices on various products, as shown in our detailed price tables.

. . . Composite Prices

	FINISHED STEEL	PIG IRON	SCRAP METAL
April 28, 1942	2.30467c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One week ago	2.30467c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One month ago	2.30467c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton
One year ago	2.30467c. a Lb.	$23.61 a Gross Ton	$19.17 a Gross Ton

	HIGH	LOW
1942	2.30467c.,	2.30467c.,
1941	2.30467c.,	2.30467c.,
1940	2.30467c., Jan. 2	2.24107c., Apr. 16
1939	2.35367c., Jan. 3	2.26689c., May 16
1938	2.58414c., Jan. 4	2.27207c., Oct. 18
1937	2.58414c., Mar. 9	2.32263c., Jan. 4
1936	2.32263c., Dec. 28	2.05200c., Mar. 10
1935	2.07642c., Oct. 1	2.06492c., Jan. 8
1934	2.15367c., Apr. 24	1.95757c., Jan. 2
1933	1.95578c., Oct. 3	1.75836c., May 2
1932	1.89196c., July 5	1.83901c., Mar. 1
1931	1.99629c., Jan. 13	1.86586c., Dec. 29
1930	2.25488c., Jan. 7	1.97319c., Dec. 9
1929	2.31773c., May 28	2.26498c., Oct. 29

Weighted index based on steel bars, beams, tank plates, wire, rails, black pipe, hot and cold-rolled sheets and strip, representing 78 per cent of the United States output. Index recapitulated in Aug. 28, 1941, issue.

	HIGH	LOW
1942	$23.61	$23.61
1941	$23.61, Mar. 20	$23.45, Jan. 2
1940	23.45, Dec. 23	22.61, Jan. 2
1939	22.61, Sept. 19	20.61, Sept. 12
1938	23.25, June 21	19.61, July 6
1937	23.25, Mar. 9	20.25, Feb. 16
1936	19.74, Nov. 24	18.73, Aug. 11
1935	18.84, Nov. 5	17.83, May 14
1934	17.90, May 1	16.90, Jan. 27
1933	16.90, Dec. 5	13.56, Jan. 3
1932	14.81, Jan. 5	13.56, Dec. 6
1931	15.90, Jan. 6	14.79, Dec. 15
1930	18.21, Jan. 7	15.90, Dec. 16
1929	18.71 May 14	18.21, Dec. 17

Based on averages for basic iron at Valley furnaces and foundry iron at Chicago, Philadelphia, Buffalo, Valley and Southern iron at Cincinnati.

	HIGH	LOW
1942	$19.17	$19.17
1941	$22.00, Jan. 7	$19.17, Apr. 10
1940	21.83, Dec. 30	16.04, Apr. 9
1939	22.50, Oct. 3	14.08, May 16
1938	15.00, Nov. 22	11.00, June 7
1937	21.92, Mar. 30	12.92, Nov. 10
1936	17.75, Dec. 21	12.67, June 9
1935	13.42, Dec. 10	10.33, Apr. 29
1934	13.00, Mar. 13	9.50, Sept. 25
1933	12.25, Aug. 8	6.75, Jan. 3
1932	8.50, Jan. 12	6.43, July 5
1931	11.33, Jan. 6	8.50, Dec. 29
1930	15.00, Feb. 18	11.25, Dec. 9
1929	17.58, Jan. 29	14.08, Dec. 3

Based on No. 1 heavy melting steel scrap quotations to consumers at Pittsburgh, Philadelphia and Chicago.

Prices of Finished Iron and Steel . . .

Steel prices shown here are f.o.b. basing points, in cents per lb., unless otherwise indicated. On some products either quantity deductions or quantity extras apply. In many cases gage, width, cutting, physical, chemical extras, etc., apply to the base price. Actual realized prices to the mill, therefore, are affected by extras, deductions, and in most cases freight absorbed to meet competition.

Basing Point → / Product ↓	Pittsburgh	Chicago	Gary	Cleveland	Birmingham	Buffalo	Youngstown	Sparrows Point	Granite City	Middletown, Ohio	Gulf Ports, Cars	Pacific Ports, Cars	DELIVERED TO Detroit	New York	Philadelphia
SHEETS															
Hot rolled	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢	2.20¢	2.10¢			2.20¢	2.35¢	2.28¢
Cold rolled[1]	3.05¢	3.05¢	3.05¢	3.05¢		3.05¢	3.05¢		3.15¢	3.05¢			3.15¢	3.41¢	3.37¢
Galvanized (24 ga.)	3.50¢	3.50¢	3.50¢		3.50¢	3.50¢	3.50¢	3.50¢	3.60¢	3.50¢				3.75¢	3.68¢
Enameling (20 ga.)	3.35¢	3.35¢	3.35¢	3.35¢			3.35¢		3.45¢	3.35¢			3.45¢	3.73¢	3.69¢
Long ternes[2]	3.80¢		3.80¢											4.18¢	4.14¢
STRIP															
Hot rolled[3]	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢			2.10¢			2.20¢	2.48¢	
Cold rolled[4]	2.80¢	2.90¢					2.80¢	(Worcester =3.00¢)					2.90¢	3.18¢	
Cooperage stock	2.20¢	2.20¢		-	2.20¢		2.20¢							2.58¢	
Commodity C-R	2.95¢			2.95¢			2.95¢	(Worcester =3.35¢)					3.05¢	3.33¢	
TIN PLATE															
Standard cokes, base box	$5.00	$5.00	$5.00						$5.10					5.38¢	$5.34
BLACK PLATE															
29 gage [5]	3.05¢	3.05¢	3.05¢						3.15¢						3.39¢
TERNES, M'FG.															
Special coated, base box	$4.30	$4.30	$4.30						$4.40						
BARS															
Carbon steel	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢		(Duluth =2.25¢)					2.25¢	2.51¢	2.49¢
Rail steel[6]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢									
Reinforcing (billet)[7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢					2.25¢	2.40¢	
Reinforcing (rail)[7]	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢	2.15¢						2.25¢		2.49¢
Cold finished[8]	2.65¢	2.65¢	2.65¢	2.65¢		2.65¢			(Detroit =2.70¢)					3.01¢	2.99¢
Alloy, hot rolled	2.70¢	2.70¢				2.70¢		(Bethlehem, Massilon, Canton =2.70¢					2.80¢		
Alloy, cold drawn	3.35¢	3.35¢	3.35¢	3.35¢		3.35¢							3.45¢		
PLATES								(Coatesville and Claymont =2.10¢)							
Carbon steel	2.10¢	2.10¢	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢	2.25¢(11)				2.25¢	2.30¢	2.155¢
Wrought iron	3.80¢														
Floor plates	3.35¢	3.35¢												3.73¢	3.69¢
Alloy	3.50¢	3.50¢			(Coatesville =3.50¢)									3.71¢	3.60¢
SHAPES															
Structural	2.10¢	2.10¢	2.10¢		2.10¢	2.10¢		(Bethlehem =2.10¢)						2.28¢	2.22¢
SPRING STEEL, C-R															
0.26 to 0.50 Carbon	2.80¢			2.80¢			(Worcester =3.00¢)								
0.51 to 0.75 Carbon	4.30¢			4.30¢			(Worcester =4.50¢)								
0.76 to 1.00 Carbon	6.15¢			6.15¢			(Worcester =6.35¢)								
1.01 to 1.25 Carbon	8.35¢			8.35¢			(Worcester =8.55¢)								
WIRE[9]															
Bright	2.60¢	2.60¢		2.60¢	2.60¢		(Worcester =2.70¢)								2.94¢
Galvanized	2.60¢	2.60¢		2.60¢	2.60¢		(Worcester =2.70¢)								2.94¢
Spring	3.20¢	3.20¢		3.20¢			(Worcester =3.30¢)								3.54¢
PILING															
Steel sheet	2.40¢	2.40¢				2.40¢									2.74¢
IRON BARS[12]															
Wrought single refined	4.40¢														
Wrought double refined	5.40¢														

[1] Mill run sheets are 10c. per 100 lb. less than base; and primes only, 25c. above base. [2] Unassorted 8-lb. coating. [3] Widths up to 12 in. [4] Carbon 0.25 per cent and less. [5] Applies to certain width and length limitations. [6] For merchant trade. [7] Prices for straight length material only, from a producer to a consumer. Functional discount of 25c. per 100 lb. to fabricators. [8] Also shafting. For quantities of 20,000 to 39,999 lb. [9] Carload lot to manufacturing trade. [11] Ship plates only. [12] Common iron bars quoted at 2.15c. by Terre Haute, Ind. producer.

MOLYBDENUM ENLISTS FOR THE DURATION

The enormous increase in requirements of molybdenum has necessitated the War Production Board Order M-110, placing molybdenum consumption under allocation control...Our metallurgical research staff is fully engaged in war work. At our mine, mill and converting plant, every effort is being made towards maximum production.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.
MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • CALCIUM MOLYBDATE

Climax Molybdenum Company
500 Fifth Avenue • New York City

MOLY

SEMI-FINISHED STEEL

Billets, Blooms and Slabs

Pittsburgh, Chicago, Gary, Cleveland, Youngstown, Buffalo, Birmingham, Sparrows Point (rerolling only). Prices delivered Detroit are $2 higher; f.o.b. Duluth, billets only, $2 higher.

	Per Gross Ton
Rerolling	$34.00
Forging quality	40.00

Shell Steel

Basic open hearth shell steel, f.o.b. Pittsburgh and Chicago.

	Per Gross Ton
3 in. to 12 in.	$52.00
12 in. to 18 in.	54.00
18 in. and over	56.00

Note: The above base prices apply on lots of 1000 tons of a size and section to which are to be added extras for chemical requirements, cutting to length, or quantity.

Sheet Bars

Pittsburgh, Chicago, Cleveland, Youngstown, Buffalo, Canton, Sparrows Point, Md.

	Per Gross Ton
Open hearth or bessemer	$34.00

Skelp

Pittsburgh, Chicago, Youngstown, Coatesville, Pa., Sparrows Point, Md.

	Per Lb.
Grooved, universal and sheared	1.90c.

Wire Rods

(No. 5 to 9/32 in.)	*Per Lb.*
Pittsburgh, Chicago, Cleveland.	2.00c.
Worcester, Mass.	2.10c.
Birmingham	2.00c.
San Francisco	2.50c.
Galveston	2.25c.

9/32 in. to 47/64 in., 0.15c. a lb. higher. Quantity extras apply.

Alloy Steel Blooms, Billets and Slabs

	Per Gross Ton
Pittsburgh, Chicago, Canton, Massillon, Buffalo or Bethlehem	$54.00

TOOL STEEL

(F.o.b. Pittsburgh, Bethlehem, Syracuse)

	Base per Lb.
High speed	67c.
Straight molybdenum	54c.
Tungsten-molybdenum	57½c.
High-carbon-chromium	43c.
Oil hardening	24c.
Special carbon	22c.
Extra carbon	18c.
Regular carbon	14c.

Warehouse prices east of Mississippi are 2c. a lb. higher; west of Mississippi, 3c. higher.

PIG IRON

All prices set in bold face type are maxima established by OPA on June 24, 1941. Other domestic prices are delivered quotations per gross ton computed on the basis of the official maxima.

	No. 2 Foundry	Basic	Bessemer	Malleable	Low Phosphorous	Charcoal
Boston††	$25.53	$25.03	$26.53	$26.03	.....	.....
Brooklyn	27.65	.....	.....	28.15	.....	.....
Jersey City	26.62	26.12	27.62	27.12	.....	.....
Philadelphia	25.89	25.39	26.89	26.39	.....	.....
Bethlehem, Pa.	**$25.00**	**$24.50**	**$26.00**	**$25.50**	.....	.....
Everett, Mass.††	**25.00**	**24.50**	**26.00**	**25.50**	.....	.....
Swedeland, Pa.	**25.00**	**24.50**	**26.00**	**25.50**	.....	.....
Steelton, Pa.	.....	**24.50**	.....	.....	**$29.50**	.....
Birdsboro, Pa.	**25.00**	**24.50**	**26.00**	**25.50**	**29.50**	.....
Sparrows Point, Md.	**25.00**	**24.50**	.....	.....	.....	.....
Erie, Pa.	**24.00**	**23.50**	**25.00**	**24.50**	.....	.....
Neville Island, Pa.	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Sharpsville, Pa.*	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Buffalo	**24.00**	**23.00**	**25.00**	**24.50**	**29.50**	.....
Cincinnati	24.68	24.68	.....	25.18	.....	.....
Canton, Ohio	25.47	24.97	25.97	25.47	.....	.....
Mansfield, Ohio	26.06	25.56	26.56	26.06	.....	.....
St. Louis	24.53	24.05	.....	.....	.....	.....
Chicago	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....$31.34
Granite City, Ill.	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Cleveland	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Hamilton, Ohio	**24.00**	**23.50**	.....	**24.00**	.....	.....
Toledo	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Youngstown*	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Detroit	**24.00**	**23.50**	**24.50**	**24.00**	.....	.....
Lake Superior fc.	.....	.....	.....	.....	.....	**$28.00**
Lyles, Tenn. fc.†	.....	.....	.....	.....	.....	**33.00**
St. Paul	26.76	.....	27.26	26.76	.....	.....
Duluth	**24.50**	.....	**25.00**	**24.50**	.....	.....
Birmingham	**20.38**	**19.00**	**25.00**	.....	.....	.....
Los Angeles	27.83	.....	.....	.....	.....	.....
San Francisco	27.83	.....	.....	.....	.....	.....
Seattle	27.83	.....	.....	.....	.....	.....
Provo, Utah	**22.00**	.....	.....	.....	.....	.....
Montreal	27.50	27.50	.....	28.00	.....	.....
Toronto	25.50	25.50	.....	26.00	.....	.....

GRAY FORGE IRON

Valley or Pittsburgh furnace $23.50

*Pittsburgh Coke & Iron Co. (Sharpsville, Pa., furnace only) and the Struthers Iron and Steel Co., Struthers, Ohio, may charge 50c. a ton in excess of basing point prices for No. 2 foundry, basic, bessemer and malleable.

††Eastern Gas & Fuel Associates, Boston, is permitted to sell pig iron produced by its selling company, Mystic Iron Works, Everett, Mass., at $1 per gross ton above maximum prices.

Switching Charges: Basing point prices are subject to an additional charge for delivery within the switching limits of the respective districts.

Silicon Differentials: Basing point prices are subject to an additional charge not to exceed 50c. a ton for each 0.25 per cent silicon content in excess of base grade (1.75 per cent to 2.25 per cent).

Phosphorous Differential: Basing point prices are subject to a reduction of 38c. per ton for phosphorous content of 0.70 per cent and over.

†Price shown is for low-phosphorous iron; high-phosphorous sells for $28.50 at the furnace.

Manganese Differentials: Basing point prices are subject to an additional charge not to exceed 50c. a ton for each 0.50 per cent manganese content in excess of 1.00 per cent.

WAREHOUSE PRICES

(Delivered Metropolitan areas, per 100 lb. See THE IRON AGE, *Dec. 25, 1941, page 88, for details of OPA Price Schedule No. 49, covering steel resale prices. These prices do not necessarily apply for dislocated tonnage shipments when the f.o.b. city prices are used in conformance with Schedule 49.)*

	Pittsburgh	Chicago	Cleveland	Philadelphia	New York	Detroit	Buffalo	Boston	Birmingham	St. Louis	St. Paul	Milwaukee	Los Angeles
Sheets, hot rolled	$3.35	$3.25	$3.35	$3.55	$3.58	$3.43	$3.25	$3.71	$3.45	$3.39	$3.50	$3.38	$4.95
Sheets, cold rolled	....	4.10	4.05	4.05	4.60	4.30	4.30	4.68	....	4.24	4.35	4.23	7.50
Sheets, galvanized	4.65	4.85	4.62	5.05	5.00	4.84	4.75	5.11	4.75	4.99	5.00	4.98	5.95
Strip, hot rolled	3.60	3.60	3.50	3.51	3.96	3.68	3.82	4.06	3.70	3.74	3.85	3.73	4.90
Strip, cold rolled	3.20	3.50	3.20	3.31	3.51	3.40	3.52	3.46	....	3.61	3.83	3.54	....
Plates	3.40	3.55	3.40	3.55	3.76	3.60	3.62	3.85	3.55	3.69	3.80	3.68	4.90
Structural shapes	3.40	3.55	3.58	3.55	3.75	3.65	3.40	3.85	3.55	3.69	3.80	3.68	4.60
Bars, hot rolled	3.35	3.50	3.25	3.85	3.84	3.43	3.35	3.98	3.50	3.64	3.75	3.63	4.35
Bars, cold finished	3.65	3.75	3.75	4.06	4.09	3.80	3.75	4.13	4.43	4.02	4.34	3.88	6.60
Bars, ht. rld. SAE 2300	7.45	7.35	7.55	7.31	7.60	7.67	7.35	7.75	....	7.72	7.45	7.58	9.55
Bars, ht. rld. SAE 3100	5.75	5.65	5.85	5.86	5.90	5.97	5.65	6.05	....	6.02	6.00	5.88	8.55
Bars, cd. drn. SAE 2300	8.40	8.40	8.40	8.56	8.84	8.70	8.40	8.88	....	8.77	8.84	8.63	10.55
Bars, cd. drn. SAE 3100	6.75	6.75	7.75	7.16	7.19	7.05	6.75	7.23	....	7.12	7.44	6.98	9.55

BASE QUANTITIES: Hot rolled sheets, cold rolled sheets, hot rolled strip, plates, shapes and hot rolled bars, 400 to 1999 lb.. galvanized sheets, 150 to 1499 lb.; cold rolled strip, extras apply on all quantities; cold finished bars, 1500 lb. and over; SAE bars, 1000 lb. and over. Exceptions: Chicago, galvanized sheets, 500 to 1499 lb.; Philadelphia, galvanized sheets, one to nine bundles, cold rolled sheets, 1000 to 1999 lb.; Detroit, galvanized sheets, 500 to 1499 lb.; Buffalo, cold rolled sheets, 500 to 1500 lb., galvanized sheets, 450 to 1499 lb., cold rolled strips, 0.0971 in. thick; Boston, cold rolled and galvanized sheets, 450 to 3749 lb.; Birmingham, hot rolled sheets, strip and bars, plates and shapes, 400 to 3999 lb., galvanized sheets, 500 to 1499 lb.; St. Louis, cold rolled sheets, 400 to 1499 lb., galvanized sheets, 500 to 1499 lb., cold rolled strip 0.095 in. and lighter; Milwaukee, cold rolled sheets, 400 to 1499 lb., galvanized sheets, 500 to 1499 lb., New York, hot rolled sheets, 0 to 1999 lb., cold rolled sheets, 400 to 1499 lb.; St. Paul, galvanized and cold rolled sheets, any quantity, hot rolled bars, plates, shapes, hot rolled sheets, 400 to 14,999 lb.; Los Angeles, hot rolled sheets, bars, plates, cold rolled sheets, 300 to 1999 lb.; galvanized sheets, 1 to 6 bundles; cold finished bars, 1 to 99 lb.; SAE bars, 100 lb. Extras for size, quality, etc., apply on above quotations. *12 gage and heavier, $3.43.


ZINC IN WAR
7 PHARMA-CEUTICALS
METAL SPRAYING
GALVAN-IZING
NICKEL SILVER
1 HULL PLATES
2 RUBBER
3 PAINT
4 BRASS
5 CERAMICS
6 DIE CASTING
"Keep 'em Healthy"
It is rather ironic that zinc is used in the brass for shells that wound men—and in pharmaceuticals that heal them. Such is the futility of wars, yet such is the widespread importance of zinc when wars are thrust upon us. The use of zinc oxide in the preparation of adhesive tape, ointments and other medicinal products is one which carries an unquestioned preference rating. Pharmaceutical (U.S.P.) zinc oxide is the purest type of zinc oxide known and it is characterized by several outstanding qualities. It is protective, mildly astringent and adhesive. The exceptional fineness and whiteness of this zinc oxide make it especially suitable in ointments, dusting powders and adhesive tape.
While most of the war uses, shown in the index of this book, involve larger tonnages of zinc than U.S.P. zinc oxide, few are more important from a utility standpoint. The needs of the Medical Departments of our armed forces are just another reason why civilian users of zinc may not be able to obtain all of the metal or pigment they would like to use.
THE NEW JERSEY ZINC COMPANY
MANUFACTURERS OF THE FAMOUS HORSE HEAD ZINC PRODUCTS
New Jersey Zinc

CORROSION AND HEAT-RESISTING STEEL

(Per lb. base price, f.o.b. Pittsburgh)

Chromium-Nickel Alloys

	No. 304	No. 302
Forging billets	21.25c.	20.40c.
Bars	25.00c.	24.00c.
Plates	29.00c.	27.00c.
Structural shapes	25.00c.	24.00c.
Sheets	36.00c.	34.00c.
Hot rolled strip	23.50c.	21.50c.
Cold rolled strip	30.00c.	28.00c.
Drawn wire	25.00c.	24.00c.

Straight-Chromium Alloys

	No. 410	No. 430	No. 442	No. 446
F.Billets	15.73c.	16.15c.	19.13c.	23.38c.
Bars	18.50c.	19.00c.	22.50c.	27.50c.
Plates	21.50c.	22.00c.	25.50c.	30.50c.
Sheets	26.50c.	29.00c.	32.50c.	36.50c.
Hotstrip	17.00c.	17.50c.	24.00c.	25.00c.
Cold st.	22.00c.	22.50c.	32.00c.	52.00c.

Chromium-Nickel Clad Steel (20%)

	No. 304
Plates	18.00c.*
Sheets	19.00c.

*Includes annealing and pickling.

ELECTRICAL SHEETS

(Base, f.o.b. Pittsburgh)

	Per Lb.
Field grade	3.20c.
Armature	3.55c.
Electrical	4.05c.
*Motor	4.95c.
*Dynamo	5.65c.
Transformer 72	6.15c.
Transformer 65	7.15c.
Transformer 58	7.65c.
Transformer 52	8.45c.

Silicon strip in coils—Sheet price plus silicon sheet extra width extra plus 25c. per 100 lb. for coils. Pacific ports add 75c. per 100 lb.

*In some instances motor grade is referred to as dynamo grade and dynamo grade is referred to as dynamo special.

ROOFING TERNE PLATE

(F.o.b. Pittsburgh, per Package of 112 Sheets)

	20x14 in.	20x28 in.
8-lb. coating I.C.	$6.00	$12.00
15-lb. coating I.C.	7.00	14.00
20-lb. coating I.C.	7.50	15.00
25-lb. coating I.C.	8.00	16.00
30-lb. coating I.C.	8.63	17.25
40-lb. coating I.C.	9.75	19.50

BOLTS, NUTS, RIVETS, SET SCREWS

Bolts and Nuts

(F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

Per Cent Off List

Machine and Carriage Bolts:

6½ in., shorter and smaller	65½
6 x ⅝ in., and shorter	63½
6 in. by ¾ to 1 in. and shorter	61
1⅛ in. and larger, all length	59
All diameters over 6 in. long	59
Lag, all sizes	62
Plow bolts	65

Nuts, Cold Punched or Hot Pressed:

(Hexagon or Square)

½ in. and smaller	62
9/16 to 1 in. inclusive	59
1⅛ to 1½ in. inclusive	57
1⅝ in. and larger	56

On above bolts and nuts, excepting plow bolts, additional allowance of 10 per cent for full container quantities. There is an additional 5 per cent allowance for carload shipments.

Semi-Fin. Hexagon Nuts	U.S.S.	S.A.E.
7/16 in. and smaller	..	64
½ in. and smaller	62	..
½ in. through 1 in.	..	60
9/16 to 1 in.	59	..
1⅛ in. through 1½ in.	57	58
1⅝ in. and larger	56	..

In full container lots, 10 per cent additional discount.

Stove bolts, packages, nuts loose 71 and 10

Stove bolts in packages, with nuts attached 71

Stove bolts in bulk 80

On stove bolts freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago, New York lots of 200 lb. or over.

Large Rivets

(½ in. and larger)

Base per 100 lb.

F.o.b. Pittsburgh, Cleveland Chicago, Birmingham $3.75

Small Rivets

(7/16 in. and smaller)

Per cent Off List

F.o.b. Pittsburgh, Cleveland, Chicago, Birmingham 65 and 5

Cap and Set Screws

Per cent Off List

Upset hex. head cap screws U.S.S. or S.A.E. thread, 1 in. and smaller	60
Upset set screws, cup and oval points	68
Milled studs	40
Flat head cap screws, listed sizes	30
Filister head cap, listed sizes	46

Freight allowed up to 65c. per 100 lb. based on Cleveland, Chicago or New York on lots of 200 lb. or over.

WIRE PRODUCTS

(To the trade, f.o.b. Pittsburgh, Chicago, Cleveland, Birmingham)

Base per Keg

Standard wire nails	$2.55
Coated nails	2.55
Cutnails, carloads	3.85

Base per 100 Lb.

Annealed fence wire	$3.05

Base Column

Woven wire fence*	67
Fence posts (carloads)	69
Single loop bale ties	59
Galvanized barbed wire†	70
Twisted barbless wire	70

*15½ gage and heavier. †On 80-rod spools in carload quantities.

Note: Birmingham base same on above items, except spring wire.

BOILER TUBES

Seamless Steel and Lap Weld Commercial Boiler Tubes and Locomotive Tubes Minimum Wall

(Net base prices per 100 ft., f.o.b. Pittsburgh, in carload lots)

	Seamless Cold Drawn	Seamless Hot Rolled	Lap Weld, Hot Rolled
	$	$	$
2 in. o.d. 13 B.W.G.	15.03	13.04	12.38
2½ in. o.d. 12 B.W.G.	20.21	17.54	16.58
3 in. o.d. 12 B.W.G.	22.48	19.50	18.35
3½ in. o.d. 11 B.W.G.	28.37	24.62	23.15
4 in. o.d. 10 B.W.G.	35.20	30.54	28.66

(Extras for less carload quantities)

40,000 lb. or ft. over	Base
30,000 lb. or ft. to 39,999 lb. or ft.	5%
20,000 lb. or ft. to 29,999 lb. or ft.	10%
10,000 lb. or ft. to 19,999 lb. or ft.	20%
5,000 lb. or ft. to 9,999 lb. or ft.	30%
2,000 lb. or ft. to 4,999 lb. or ft.	45%
Under 2,000 lb. or ft.	65%

STEEL AND WROUGHT IRON PIPE AND TUBING

Welded Pipe

Base Discounts, f.o.b. Pittsburgh District and Lorain, Ohio, Mills

(F.o.b. Pittsburgh only on wrought pipe)

Base Price—$2.00 Per Net Ton

Steel (Butt Weld)

	Black	Galv.
½ in.	63½	51
¾ in.	66½	55
1 to 3 in.	68½	57½

Wrought Iron (Butt Weld)

½ in.	24	3½
¾ in.	30	10
1 and 1¼ in.	34	16
1½ in.	38	18½
2 in.	37½	18

Steel (Lap Weld)

2 in.	61	49½
2½ and 3 in.	64	52½
3½ to 6 in.	66	54½

Wrought Iron (Lap Weld)

2 in.	30½	12
2½ to 3½ in.	31½	14½
4 in.	33½	18
4½ to 8 in.	32½	17

Steel (Butt, extra strong, plain ends)

	Black	Galv.
½ in.	61½	50½
¾ in.	65½	54½
1 to 3 in.	67	57

Wrought Iron (Same as Above)

½ in.	25	6
¾ in.	31	12
1 to 2 in.	38	19½

Steel (Lap, extra strong, plain ends)

2 in.	59	48½
2½ and 3 in.	63	52½
3½ to 6 in.	66½	56

Wrought Iron (Same as Above)

2 in.	33½	15½
2½ to 4 in.	39	22½
4½ to 6 in.	37½	21

On butt weld and lap weld steel pipe jobbers are granted a discount of 5%. On less-than-carload shipments prices are determined by adding 25 and 30% and the carload freight rate to the base card.

F.o.b. Gary prices are two points lower discount or $4 a ton higher than Pittsburgh or Lorain on lap weld and one point lower discount, or $2 a ton higher on all butt weld 8 in. and smaller.

CAST IRON WATER PIPE

Per Net Ton

6-in. and larger, del'd Chicago	$54.80
6-in. and larger, del'd New York	52.20
6-in. and larger, Birmingham	46.00
6-in. and larger f.o.b. dock, San Francisco or Los Angeles or Seattle	56.00

Class "A" and gas pipe, $3 extra; 4-in. pipe is $3 a ton above 6-in. Prices shown are for lots of less than 200 tons. For 200 tons or over, 6-in. and larger is $45 at Birmingham and $53.80 delivered Chicago.

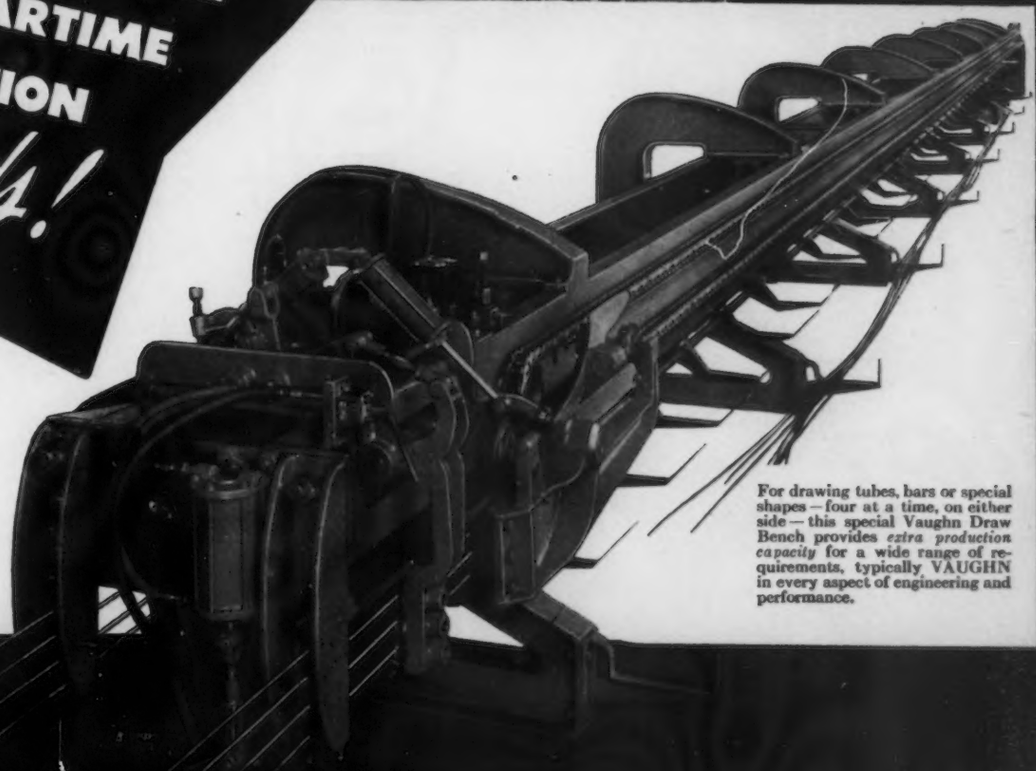
FUEL OIL

No. 3, f.o.b. Bayonne, N. J.	5.20c.
No. 6, f.o.b. Bayonne, N. J.	3.21c.
No. 6 Bur. Stds., del'd Chicago	4.50c.
No. 3 distillate del'd Cleveland	6.50c.
No. 4 indus., del'd Cleveland	6.00c.
No. 6 indus., del'd Cleveland	5.00c.

Vaughn

—SERVE SMOOTHLY and WELL UNDER WARTIME PRODUCTION *demands!*

Make your schedules short as you must—*then beat 'em,* with the dependable help of your VAUGHN Cold Drawing Machinery!



For drawing tubes, bars or special shapes—four at a time, on either side—this special Vaughn Draw Bench provides *extra production capacity* for a wide range of requirements, typically VAUGHN in every aspect of engineering and performance.

THE VAUGHN MACHINERY CO.

CUYAHOGA FALLS, OHIO, U. S. A.

FERROALLOYS

Ferromanganese

F.o.b. New York, Philadelphia, Baltimore, Mobile or New Orleans, Domestic, 80%, per gross ton (carloads).....$120.00

Spiegeleisen

Per Gross Ton Furnace

Domestic, 19 to 21%.....$36.00
Domestic, 26 to 28%..... 49.50

Electric Ferrosilicon

(Per Gross Ton, Delivered Lump Size)

50% (carload lots, bulk).....$74.50
50% (ton lots, packed)..... 87.00
75% (carload lots, bulk).....135.00
75% (ton lots, packed).....151.00

Silvery Iron

(Per Gross Ton, base 6.00 to 6.50 Si)

F.o.b. Jackson, Ohio.....$29.50*
Buffalo 30.75*

For each addition 0.50% silicon add $1 a ton. For each 0.50% manganese over 1% add 50c. a ton. Add $1 a ton for 0.75% phosphorus or over.

*Official OPACS price established June 24.

Bessemer Ferrosilicon

Prices are $1 a ton above Silvery Iron quotations of comparable analysis.

Ferrochrome

(Per Lb., Contained Cr, Delivered Carlots, Lump Size, on Contract)

4 to 6 carbon.....13.00c.
2 carbon .....19.50c.
1 carbon .....20.50c.
0.10 carbon .....22.50c.
0.06 carbon .....23.00c.

Spot prices are ¼c. per lb. of contained chromium higher.

Silico-Manganese

(Per Gross Ton, Delivered, Lump Size, Bulk, on Contract)

3 carbon $113.00*
2.50 carbon 118.00*
2 carbon 123.00*
1 carbon 133.00*

Other Ferroalloys

Ferrotungsten, per lb. contained W, del'd carload..... $2.00
Ferrotungsten, 100 lb. and less 2.25
Ferrovanadium, contract, per lb. contained V, del'd $2.70 to $2.90†
Ferrocolumbium, per lb. contained Cb, f.o.b. Niagara Falls, N. Y., ton lots..... $2.25†
Ferrocarbontitanium, 15-18 Ti, 7-8 C, f.o.b. furnace, carload, contract, net ton.....$142.50
Ferrocarbontitanium, 17-20 Ti, 3-5 C, f.o.b. furnace, carload, contract, net ton.....$157.50
Ferrophosphorus, electric or blast furnace material, carloads, f.o.b. Anniston, Ala., for 18%, with $3 unitage freight, equaled with Rockdale, Tenn., gross ton..... $58.50
Ferrophosphorus, electrolytic 23-26%, carlots, f.o.b. Monsanto (Siglo), Tenn., $3 unitage, freight equalized with Nashville, gross ton..... $75.00
Ferromolybdenum, per lb. Mo, f.o.b. furnace ..... 95c.
Calcium molybdate, per lb. Mo, f.o.b. furnace..... 80c.
Molybdenum oxide briquettes 48-52 Mo, per lb. contained Mo, f.o.b. Langeloth, Pa.... 80c.
Molybdenum oxide, in cans, per lb. contained Mo, f.o.b. Langeloth, and Washington, Pa. 80c.

*Spot prices are $5 per ton higher.
†Spot prices are 10c. per lb. of contained element higher.

ORES

Lake Superior Ores (51.50% Fe.)

(Delivered Lower Lake Ports)

Per Gross Ton

Old Range, bessemer, 51.50.....$4.75
Old range, non-bessemer, 51.50. 4.60
Mesaba, bessemer, 51.50..... 4.60
Mesaba, non-bessemer, 51.50.... 4.45
High phosphorus, 51.50..... 4.35

Foreign Ores*

(C.i.f. Philadelphia or Baltimore, Exclusive of Duty)

Per Unit

African, 46-48 Mn.....66.5c. to 68c.
Indian, 48-50 Mn. .....68c. to 70c.
Brazilian, 46-48 Mn.....67c. to 68c.
Cuban, 51 Mn. .....81c.

Per Short Ton Unit

Tungsten, Chinese, Wolframite, duty paid, delivered.....$24 to $26
Tungsten, domestic scheelite, at mine .....$24.00 to $25.00
Chrome ore, lump, c.i.f. Atlantic Seaboard, per gros ton; South African (low grade)..$28.00
Rhodesian, 45 .....Nom.
Rhodesian, 48 .....Nom.

*Importations no longer readily available. Prices shown are nominal.

COKE*

Furnace

Per Net Ton

†Connellsville, prompt $6.00

Foundry

†Connellsville, prompt..$6.75 to $7.00

*Maximum by-product coke prices established by OPA became effective Oct. 1, 1941. A complete schedule of the ceiling prices was published in THE IRON AGE, Sept. 25, p. 94B. Maximum beehive furnace coke prices established by OPA, Jan. 26. †F.O.B. oven.

By-product, Chicago $12.25
By-product, New England.....$13.75
By-product, Newark..$12.40 to $12.95
By-product, Philadelphia $12.38
By-product, Cleveland $12.30
By-product, Cincinnati $11.75
By-product, Birmingham .....$8.50†
By-product, St. Louis $12.02
By-product, Buffalo $12.50

RAILS, TRACK SUPPLIES

(F.o.b. Mill)

Sandard rails, heavier than 60 lb., gross ton.....$40.00
Angle bars, 100 lb..... 2.70

(F.o.b. Basing Points) *Per Gross Ton*

Light rails (from billets).....$40.00
Light rails (from rail steel)... 39.00

Base per Lb.

Cut spikes ..... 3.00c.
Screw spikes ..... 5.15c.
Tie plates, steel ..... 2.15c.
Tie plates, Pacific Coast..... 2.30c.
Track bolts, heat treated, to railroads ..... 5.00c.
Track bolts, jobbers discount.. 63-5

Basing points, light rails—Pittsburgh, Chicago, Birmingham; spikes and tie plates—Pittsburgh, Chicago, Portsmouth, Ohio, Weirton, W. Va., St. Louis, Kansas City, Minneaqua, Colo., Birmingham and Pacific Coast ports; tie plates alone—Steelton, Pa., Buffalo; spikes alone—Youngstown, Lebanon, Pa., Richmond, Va.

FLUORSPAR

Fire Clay Brick *Per Net Ton*

Domestic washed gravel, 85-5 f.o.b. Kentucky and Illinois mines, all rail $25.00
Domestic, f.o.b. Ohio River landing barges 25.00
No. 2 lump, 85-5 f.o.b. Kentucky and Illinois mines 25.00
Foreign, 85% calcium fluoride, not over 5% Si, c.i.f. Atlantic ports, duty paid.....Nominal
Domestic No. 1 ground bulk, 96 to 98%, calcium fluoride, not over 2½% silicon, f.o.b. Illinois and Kentucky mines....$34.00
As above, in bags, f.o.b. same mines 36.40

REFRACTORIES

(F.o.b. Works)

Fire Clay Brick *Per 1000*

Super-duty brick, St. Louis...$64.60
First quality, Pennsylvania, Maryland, Kentucky, Missouri and Illinois 51.30
First quality, New Jersey..... 56.00
Second quality, Pennsylvania, Maryland, Kentucky, Missouri and Illinois 46.55
Second quality, New Jersey... 51.00
No. 1, Ohio..... 43.00
Ground fire clay, net ton..... 7.60

Silica Brick

Pennsylvania $51.30
Chicago District 58.90
Birmingham 51.30
Silica cement, net ton (Eastern) 9.00

Chrome Brick *Per Net Ton*

Standard, f.o.b. Baltimore, Plymouth Meeting and Chester...$54.00
Chemically bonded, f.o.b. Baltimore, Plymouth Meeting and Chester, Pa. 54.00

Magnesite Brick

Standard f.o.b. Baltimore and Chester $76.00
Chemically bonded, f.o.b. Baltimore 65.00

Grain Magnesite

Domestic, f.o.b. Baltimore and Chester in sacks.....$44.00
Domestic, f.o.b. Chewelah, Wash. (in bulk) 22.00